TECHNOLOGY DEPT.

Grinding and Finishing

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How Belts Are Used In Jet Blade Finishing —page 48

Snagging stainless billet at U. S. Steel —begins page 30

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cutting gaging abrasive cutting barrel finishing polishing lapping honing grinding

MACHINE TOOL ACCESSORIES, PRECISION TOOLS, PUMPS

CITY STATE

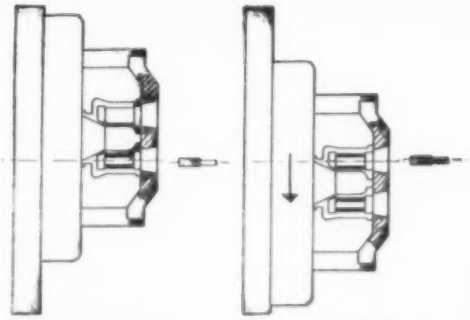
AUTO-INDEXING permits

single chucking for double bore grinding

Manually re-locating a part to grind a *second* bore takes valuable operator time. This time can be saved, in many instances, by the use of an auto-indexing fixture on a Heald Internal Grinder. For example, the Model 271 Size-Matic shown below precision grinds *two* interrupted bores in a universal joint body in a single, fully automatic, 71-second cycle.

The diagrams at right show how both bores of the work are brought in line with the grinding wheel – automatically!

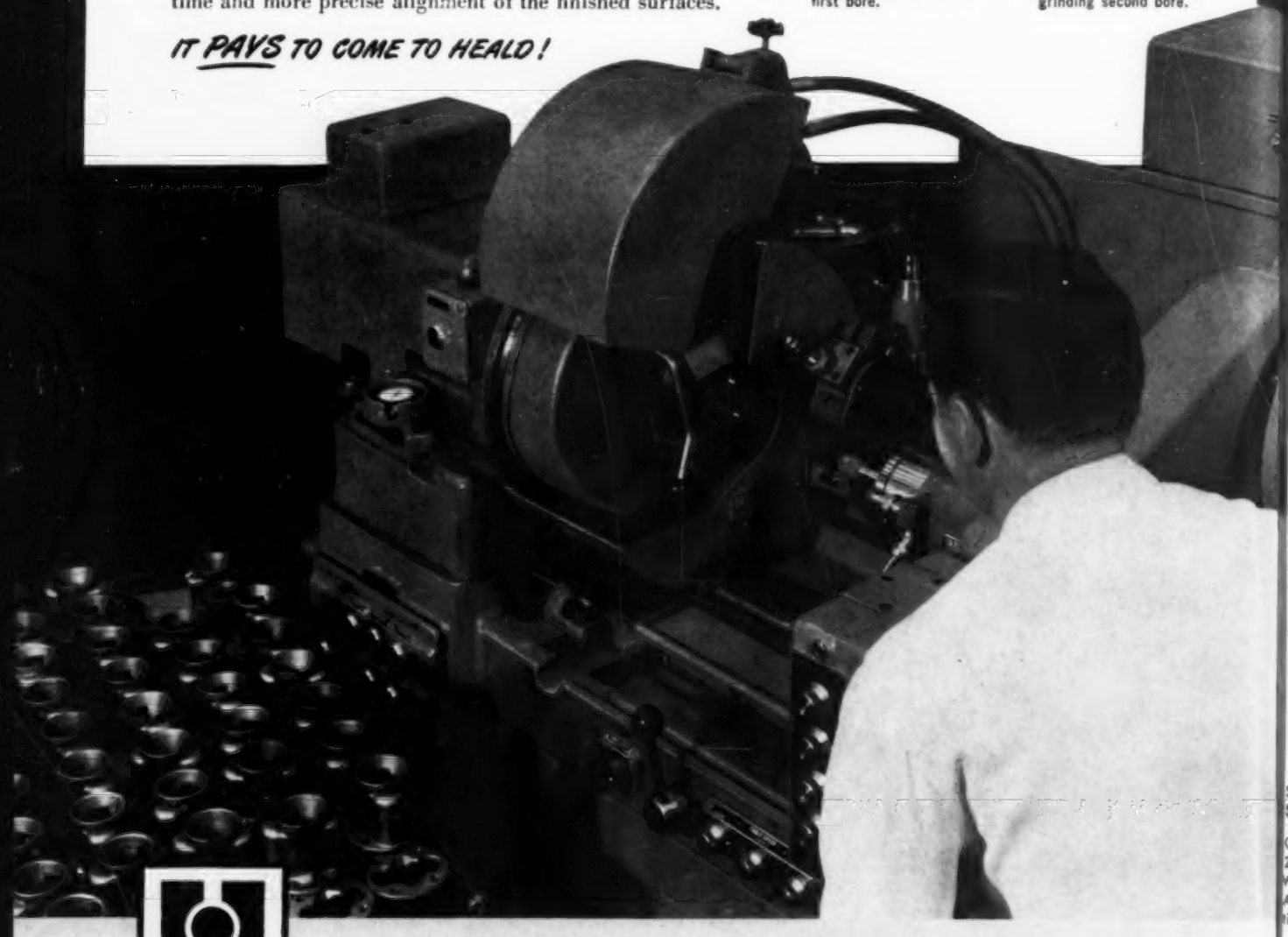
This auto-indexing feature can be used for many two-bore grinding jobs of this type with substantial savings in handling time and more precise alignment of the finished surfaces.



Auto-indexing fixture in position for grinding first bore.

Rotary cross-feed unit indexed to position for grinding second bore.

IT PAYS TO COME TO HEALD!



HEALD

THE HEALD MACHINE COMPANY Worcester 6, Massachusetts

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● Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

Contents • April 1957

Grinding and Finishing

the magazine of abrasive metalworking operations

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BPA

FEATURE ARTICLES

How to Reduce Snagging Costs by Proper Wheel Testing 30
Best possible testing program includes: eliminating variables, evaluating results, deriving true costs, picking wheel vendors. By A. S. Wyborski.

Horizontal Spindle Surface Grinding 37
Part 2 of series discusses fundamentals and methods. By Grinding and Finishing *editorial staff*

How Central Coolant Systems Improved Race Grinding at Fafnir 44
On critical finish grinding jobs, system has lengthened wheel life, improved part quality. By C. A. Wallace.

How Belts Are Used in Jet Blade Finishing 48
Automatic and offhand methods for buckets and blades depends on good belt application. By J. Karl McLaughlin.

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Optical comparison on the grinder aligns aircraft components for working to close limits.

Pratt & Whitney Announces Numerical Control for Vertical Hole Grinders 55
Positioning system for machine table uses punched tape to translate blueprint information to accurate location.

What Does Illness Cost Industry? 63
Employees lose 13% of yearly income, nation's toll is billions five-year study of illness-absenteeism shows.

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COVER: Grinding a stainless steel slab with a swing frame grinder at the U.S. Steel South Works, near Chicago. Removal of surface imperfections prepares the slab for further rolling and helps insure sound steel in the finished product. A realistic approach to the testing and selection of snagging wheels is given in our feature article by A. S. Wyborski beginning on page 30 of this issue.

Cincinnati Filmatic

Highest quality of sizing and roundness is obtained at low cost by grinding these anti-friction bearing rings on a CINCINNATI FILMATIC No. 4 Centerless Grinder equipped with Power Race Grinding Fixture.

(Photo courtesy of McGill Manufacturing Company, Inc., Valparaiso, Indiana

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE

Nos. 0 2 3 4 5 6 Centerless

The No. 4 is the machine for this job . . . grinding thin wall rings to perfect roundness

FILMATIC

Thin wall rings are extra sensitive to OD grinding pressure . . . the lower it is, the better for accuracy. A prominent manufacturer of precision anti-friction bearings is well acquainted with this factor in production work, and keeps it under control by grinding large diameter rings on a CINCINNATI® FILMATIC No. 4 Centerless. And there's a good reason for choosing the No. 4. The bed is inclined at a 30° angle, resulting in an increased driving effort by the regulating wheel. Even with no grinding wheel contact, the work rotates with the regulating wheel. ¶ Other advantages of CINCINNATI FILMATIC No. 4 Centerless Grinders include: self-adjusting grinding wheel spindle bearings (they're FILMATIC, of course) . . . hydraulic grinding wheel truing . . . independent 400 rpm truing speed for regulating wheel . . . no collets required for regulating wheel . . . 30 hp main drive. ¶ Only Cincinnati can offer a choice of six sizes of fine centerless grinding machines. You will find brief specifications for all of them in Sweet's Machine Tool Catalog File.

CINCINNATI GRINDERS INCORPORATED CINCINNATI 9, OHIO

CINCINNATI FILMATIC No. 4 CENTERLESS GRINDING MACHINE

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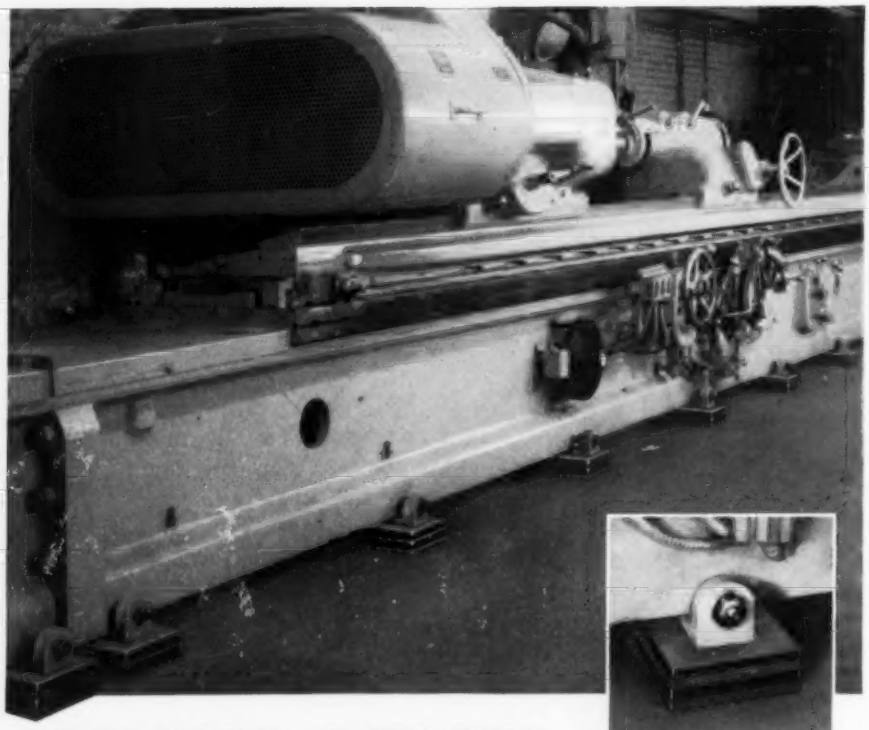
45-TON GRINDER INSTALLED ON Air-Loc



STAYS LEVEL TO .0005"

Insert shows use of **Air-Loc** and leveling plates. No bolts or cement needed.

This Norton Grinder, installed on 26 AIR-LOC mounts, is regularly checked for level at 3-month intervals . . . and always holds the .0005" level required by manufacturer's specifications, with no adjustments necessary.

Jigborers, grinders, lathes . . . all of your fine tolerance precision machines . . . should be installed on AIR-LOC to safeguard the accuracy originally built into them by the manufacturers.

Air-Loc

You get a permanent precision installation with patented AIR-LOC mounts that *Resist* oil, water and alkali, *Permit* easy leveling, *Eliminate* need for bolts or cement, *Hold* machines in place, *Reduce* transmitted vibration from the floor.

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Letters to the Editor

Those Russian Engineers

I have just read your editorial of February, 1957, entitled "Those Russian Engineers." Amen!

Some of us in the engineering field look with considerable alarm upon hysterical attempts to "load" the profession with many people who would not make good engineers. Contrariwise, we are doing everything we can to stimulate a genuine interest on the part of those who are capable and should consider the profession.

You might enjoy reading a paper which I recently presented on this subject, and which is found on page 3 of the attached copy of "The News in Engineering." It is entitled "Technical Manpower Mirages."

Gordon B. Carson
Dean, College of Engineering
The Ohio State University

Standard Time Data

I have been following with interest articles on developing standard data for grinding operations and would appreciate receiving reprints on above subject written by Mr. E. A. Cyrol.

In one of your issues it was stated that it was expected that reprints would be available some time in February, 1957.

Donald J. Morin
Assistant to Pricing Analyst
Bryant Chucking Grinder

The standard time data series is now at the printers and will be available next month. All orders will be filled at that time.—Ed.

Break Edge Work

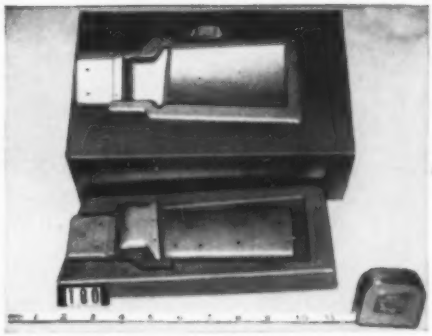
. . . do you have any articles on burring and break edge other than barrel finishing information?

Is there any gage in existence that will determine an .005-.015 or .020-.040 break edge other than a comparator and also how can we be sure the break edge has been done to blueprint

(continued page 6)

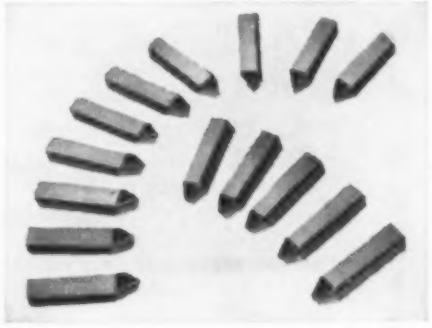
FORGING DIE

Material: Heppenstall 'A'
Conventional Machining
Time: 40 hours
Elox Setup & Machining
Time: 8 hours
Saved: 32 hours
Machine tool: Elox Standard M-500
Electrode: Cast Elo-met #3
Customers report 75% time saving in re-working dies after washout . . . no annealing is necessary.



TUNGSTEN CARBIDE SINGLE POINT TOOLS

E D M produces 14 identically machined tools per hour. Times include roughing and finishing, machining both faces, nose radius and top. Radius held to ± .001". Tools were produced by 1 man operating 2 Elox Tool & Cutter Grinders, using a brass wheel. Users report Elox ground tools give greatly increased life when compared to abrasive ground tools.



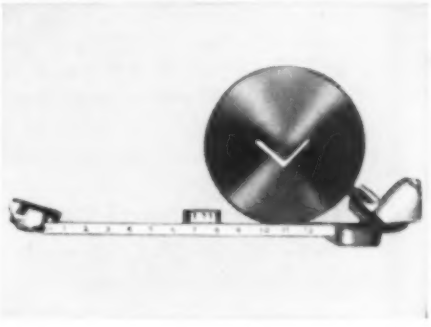
EMBOSSING DIE

Material: Air Hardened Tool Steel
Die consists of 1,250 squares machined .100" x .030" deep in the bottom section of the die. Sharp corners on each square had to be maintained.

Conventional Machining
Time: 227 hours
Elox Setup & Machining
Time: 10 hours
Saved: 217 hours
Machine Tool: Elox Standard M-500
Electrode: Free machining brass

EXTRUSION DIE

Material: Air Hardened Tool Steel
Conventional
Machining Time: 4 hours
Elox Setup &
Machining Time: 1 hr. 38 min.
Saved: 2 Hrs. 22 min.
Machine Tool: Elox Standard M-500
Electrode: Free machining brass
Machining is done after final heat treating . . . eliminating the possibility of distortion.



FROM THE HEART OF EDM

. . . 4 jobs that prove Elox puts you ahead of competition

These jobs were done for Elox customers in our "Prove It" Division. There's more to them than just "man hours" saved. The Elox sales engineer in your area would like to give you all the details about these and other applications of Electrical Discharge Machining. Why not write . . .

elox *corporation of michigan* *T. M. Reg.

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Royal Oak 3, Michigan

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How to find a perfect mate!

SPITFIRE

"Nth degree" LAPPING MACHINES

Valve components, mechanical seals, many other parts require perfect mates . . . possible by producing surfaces of precision flatness and finish. This quality control is "built-in" around the world . . . with Spitfire Machines.

whatever your lapping requirements . . . SPITFIRE offers the proved answer:

Automatic Gyro-Matic "21"

Three basic elements: the human, mechanical and economical . . . are combined in the Gyro-Matic "21". Simple operation means any production worker can produce precision lapped parts. Micro-inch lapping to .0000116" flatness is standard. Rapid push-button control minimizes man-hours. Where critical parts are standard . . . so is the Spitfire Gyro-Matic "21".

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Permits any size firm to incorporate super fine finishing on most production lines. The most economical method of attaining high level parts quality control.

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For closest tolerance finishes to 1 RMS or less on plug gages, shoulders, all types of cylindrical parts. Available in floor and bench type models.

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requirements? Our method here, practically guess work or opinion, until the part reaches final inspection where, in the past it has been rejected for not having the proper break edge requiring parts to be returned and reworked, naturally raising the cost. Production and time are also being affected and these are all important factors.

Perhaps you can help in answering this problem.

F. H. H.
Special Process Engineer
Milford, Connecticut

The only process other than barrel finishing that comes to mind on your deburring problem is abrasive blasting, which is highly effective on high production deburring for almost any part material. Our recent article on operations in the Chrysler Kokomo transmission plant pointed out their mechanized blasting units for aluminum die castings and the like, using crushed walnut shells as the abrasive. Blasting has put deburring on a very dependable basis in the Kokomo plant and would be suitable for production deburring, depending on the nature of your part.

As to a suitable gage for the break edge radii you mention, we can sympathize with your on-the-job inspection problem, because about the finest radius that can be distinguished accurately by the unaided eye is .010-inch. Depending on the nature of the part and the processing method, by optical comparator methods you should be able to grind the proper radius into the form tool used to do the break edge job. But to check the accuracy on the job, which seems to be your problem, we might suggest that you contact the Edmund Scientific Corp., 99 E. Gloucester Pike, N.J., for a pocket-type optical comparator that an operator might use on the job.

Cone Shaped Barrel Media

We recall seeing in GRINDING AND FINISHING some information concerning some new tumbling abrasive pellets that were cone shaped.

From recent inquiries all we can find in this shape now are nylon pellets, whereas we would like to find the cone shaped pellets in some abrasive material. If you could supply us with any information as to where this abrasive material may be obtained, we will appreciate it.

We read your magazine regularly

(continued page 16)

Meet WALTER AUGUSTEN

Bryant field engineer in the Indianapolis, Indiana area. For detailed information on how Bryant can help improve production in *your* plant, call Mr. AUGUSTEN at CLIFFORD 5-8809 in Indianapolis, Indiana, 2037 East 46th Street.

The 1957 Chrysler Imperial

A Bryant 2209-Y grinds transmission output shafts at Chrysler's new Kokomo, Indiana Torque Flite Automatic Transmission Plant.

Chrysler "guns" its production with BRYANT INTERNAL GRINDERS

The automatic transmissions in 1957 Chryslers – and in all other Chrysler-built cars – are designed for long-lasting, trouble-free operation. Making them so, and doing it profitably, calls for mass-producing the precision machined parts, such as transmission output shafts.

Bryant Internal Grinders speed up the production of these precision components in many ways. Combining operations – bore and face grinding simultaneously as illustrated – is one way.

As with fine cars, there's a Bryant Internal Grinder – manual, semi-automatic or automatic designed to suit your particular requirements.

Why not investigate how Bryant's engineering service can help you attain higher production at lower operating costs.

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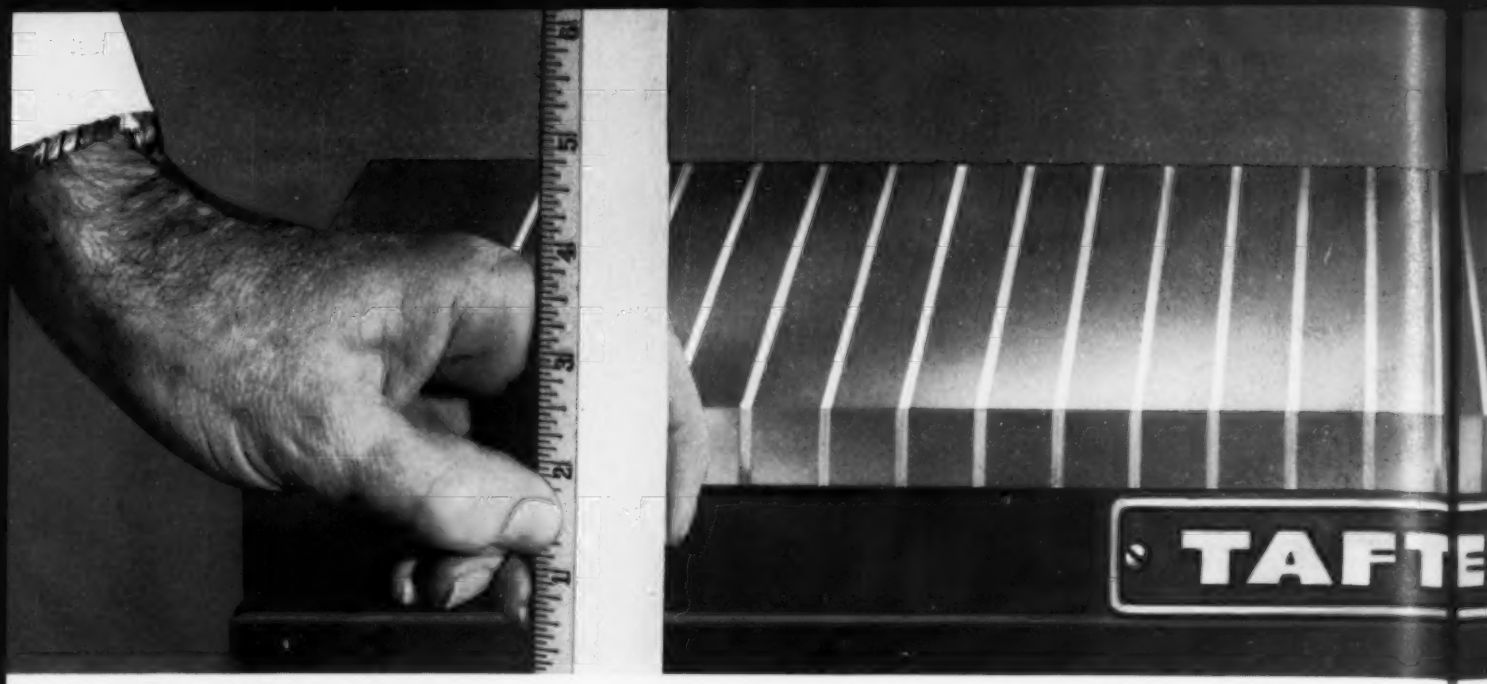


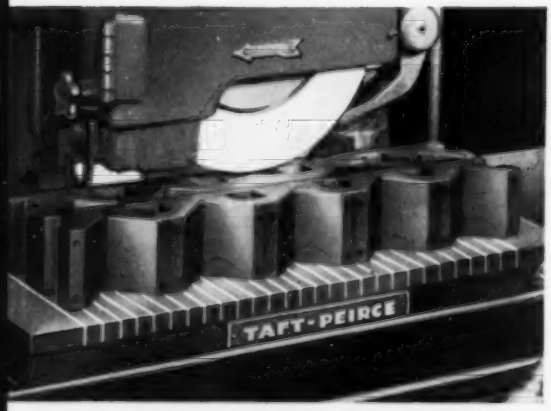
❶ LESS THAN 2½″ HIGH. New low-boy design increases work capacity between wheel and faceplate by 1″ to 1½″ over conventional 8″ x 24″ chucks . . . a natural for handling the big jobs.

new

TAFT-PEIRCE 824*

PERMANENT MAGNET CHUCK

Low . . . Powerful . . . Precise . . . Easy to use



❷ 28% MORE HOLDING POWER . . . specially engineered pack and concentration of flux gives extra holding power to handle practically all jobs, without complicated setups and with reduced costs.

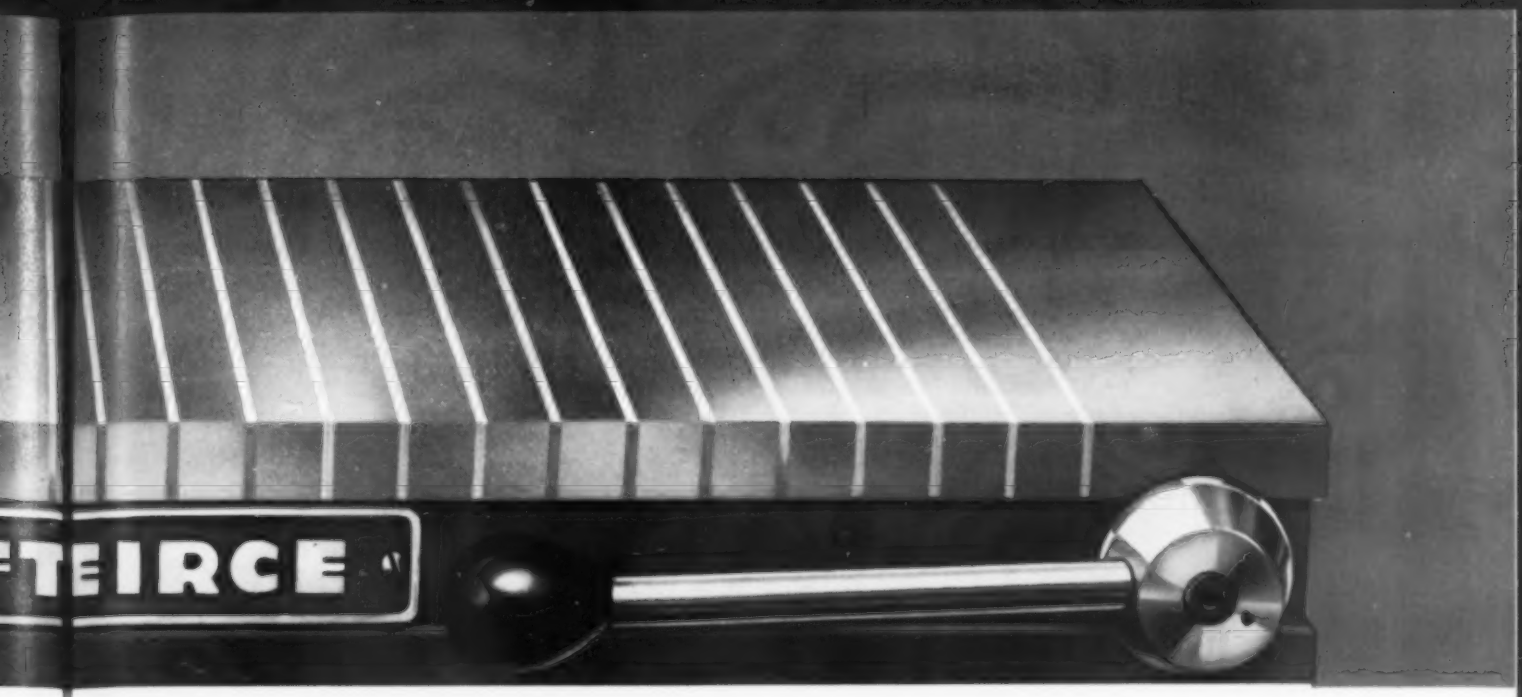
There's a lot of utility and cost saving packed into the new Taft-Peirce 824!

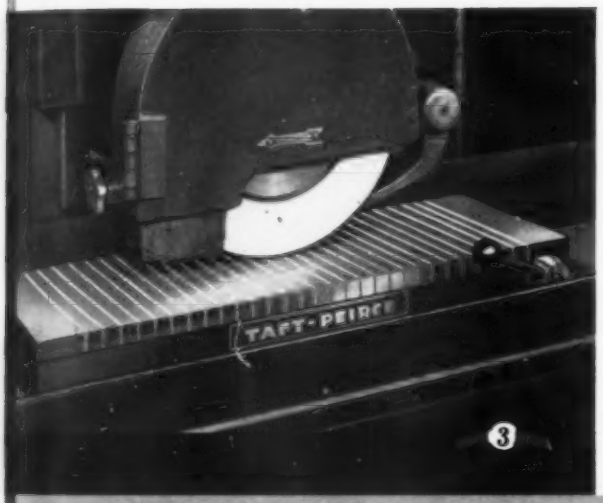
The 824 has been designed especially for *your* tooling and production requirements. Special Alnico V magnet design gives 100% all-over power, no dead spots — full edge-to-edge usable surface for ganging small parts or safely holding big ones. Holding power is better than ever — it's 28% stronger than comparable units.

Another big plus is the unique concept in faceplate design. New epoxy resin non-magnetic separators and special assembly techniques provide unusual stability and a much lighter chuck.

Check the many other shop tested features you see pictured on this page — a total of six exclusive advantages the new 824 brings to metalworking. The new 824 is ready now — through your nearest Taft-Peirce dealer or send your order to: The Taft-Peirce Manufacturing Co., Woonsocket, R. I.

*PAT. APPLIED FOR

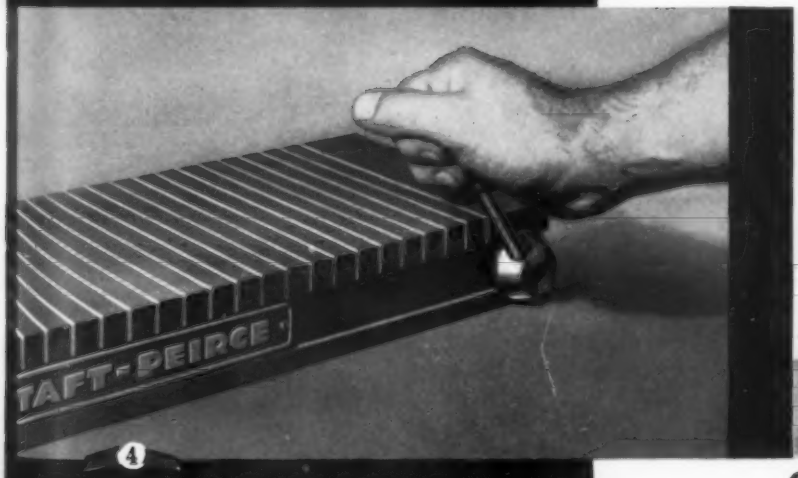


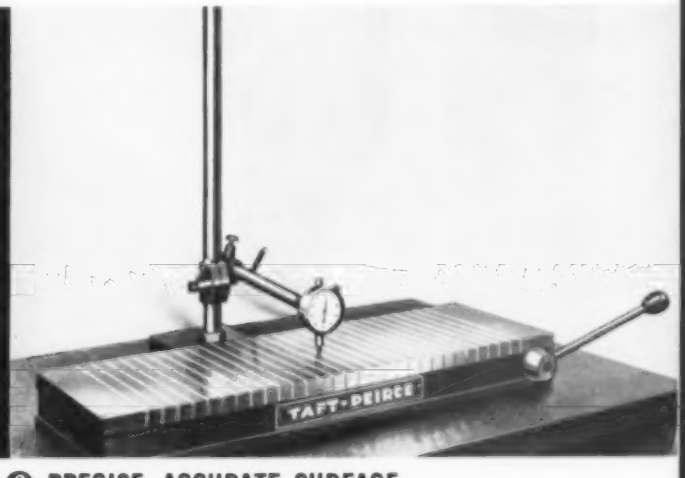


3 CHUCK DRESSES WITHOUT WHEEL LOADING... new type separators keep the wheel clean. Grinding operations are streamlined, and unproductive time is cut to the minimum.

4 NO MORE TROUBLE WITH RESIDUAL MAGNETISM... pack moves easily and quickly. With handle in "off" position, operator can get workpieces on and off the chuck in seconds.

5 27% LESS WEIGHT... than other chucks of the same size. Easy to handle — promotes greater utility, handy for ganging to handle big milling or grinding jobs.





6 PRECISE, ACCURATE SURFACE... faceplate uses production-proved epoxy resin separators. Surface is more stable — perfect for close tolerance work.

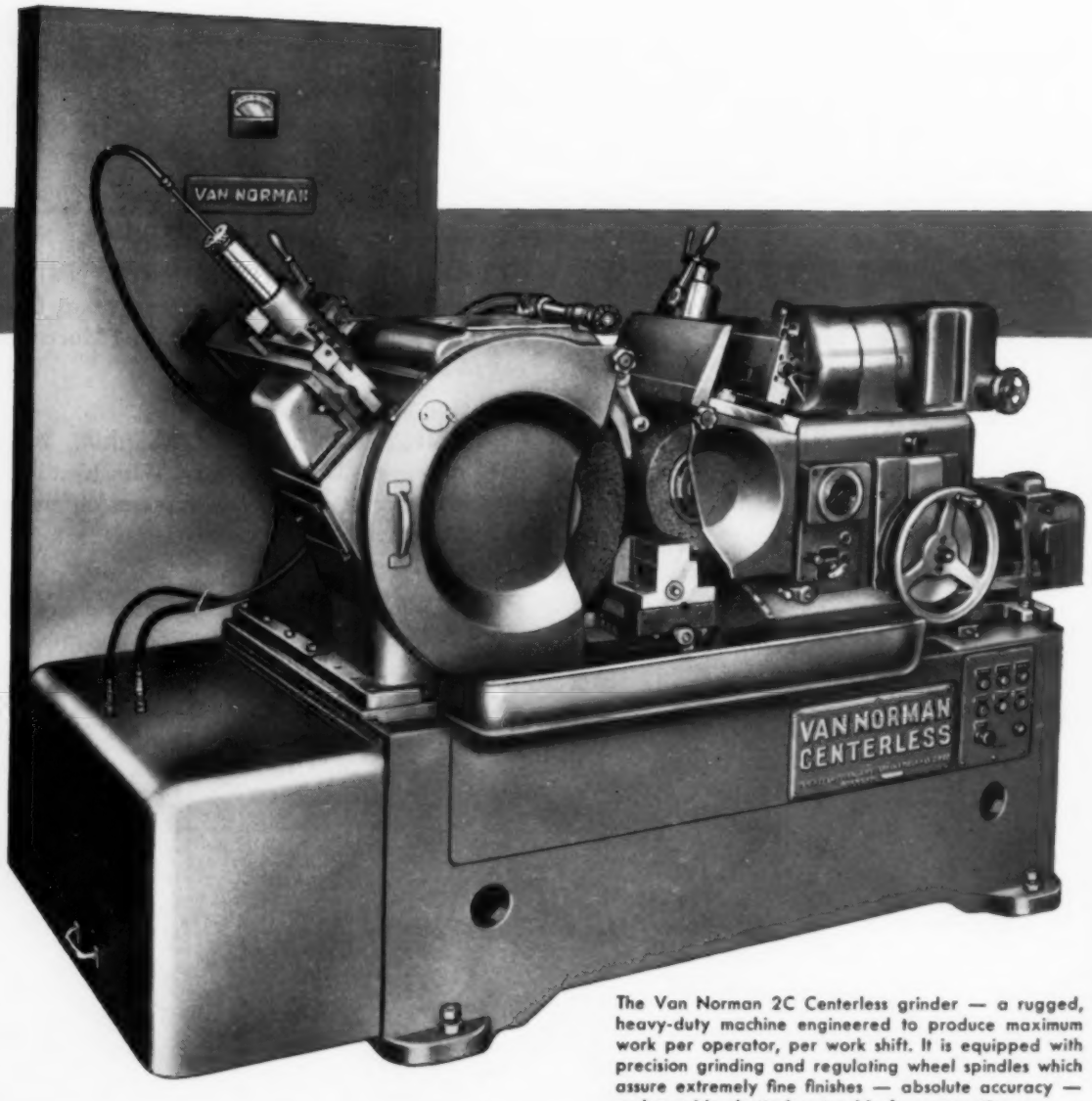
T P

TAKE IT TO TAFT-PEIRCE

T-P Means TOP Precision

VAN NORMAN

Centerless



The Van Norman 2C Centerless grinder — a rugged, heavy-duty machine engineered to produce maximum work per operator, per work shift. It is equipped with precision grinding and regulating wheel spindles which assure extremely fine finishes — absolute accuracy — and provide chatterless trouble-free operation.

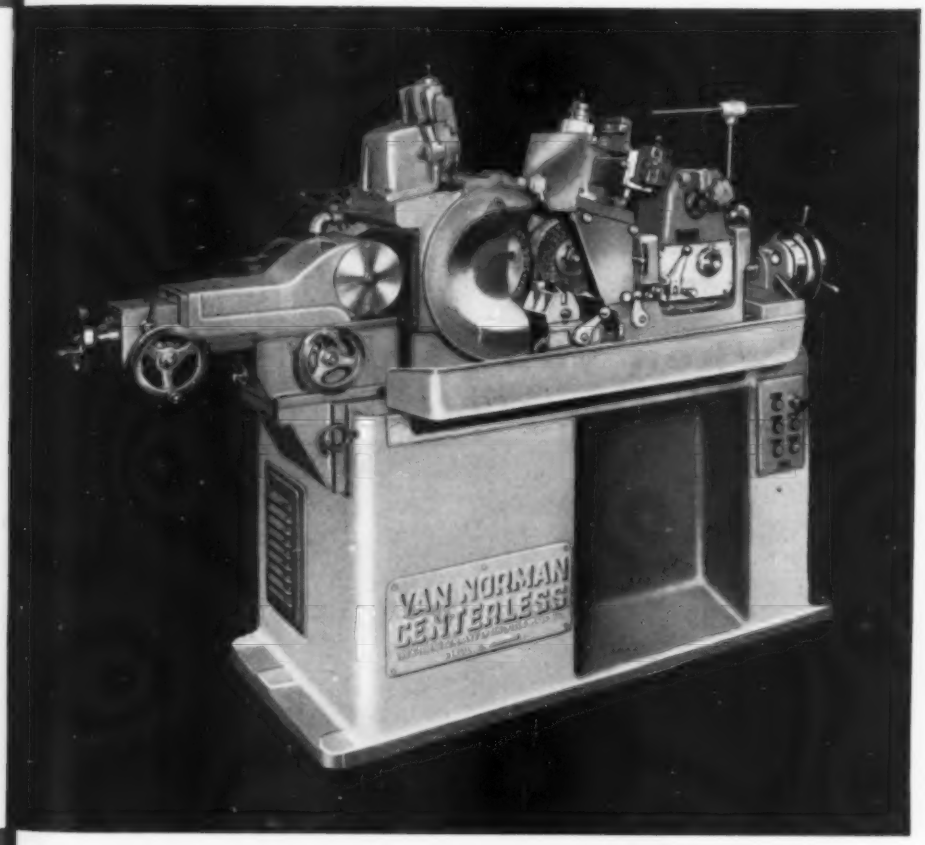
VAN NORMAN MACHINE

a division of Van Norman Industries, Inc.

MANUFACTURERS of—Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

Grinders

Precision Grind Parts Fast, Economically, To Close Tolerances



The Van Norman 1C Centerless grinder — finish grinds some small parts from solid . . . or finish grinds rough-turned parts. The 1C is especially suited for grinding parts used in business and office machines, sewing machines, electrical appliances, aircraft, automobiles, munitions and similar work.

Van Norman Centerless grinders are precision-manufactured to produce a wide variety of parts made of metal, wood, fibre, plastic or glass. Actually these Van Norman Centerless grinders are three machines in one . . . will handle thru-feed work, in-feed work and — equipped with a Crush Dressing Attachment — form grinding and profile work. Get complete details on the Van Norman 1C and 2C Centerless grinders. Write, wire or telephone for catalog.

COMPANY
SPRINGFIELD 7, MASSACHUSETTS

Don't wait . . . for extra profit install a Van Norman machine now! They are available in many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate up to 10 years.

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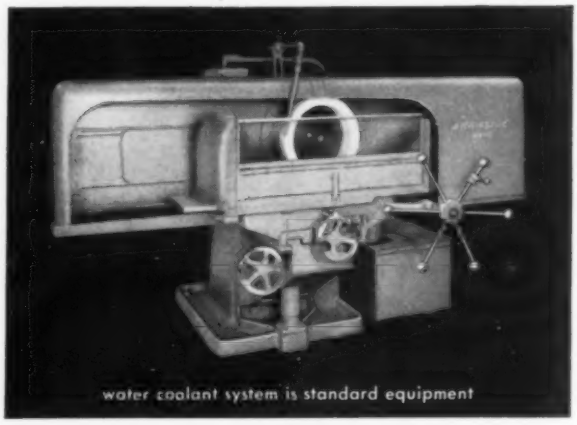
why MACHINE it off—when you can GRIND it?

Stock really comes off with an Abrasive 18″ Face Grinder. Sixty-five thousandths of an inch at a pass! A rugged 15 H.P. motorized Abrasive spindle turns the wheel at 900 R.P.M. Surface speed is 4500 feet per minute. 24″ table travel, plus 18″ wheel gives big work capacity.

Time is money! Machining flat surfaces wastes both! Grind it off faster, with better surface finishes, with an Abrasive 18″ Face Grinder just as leading metalworking plants — those really making money — are grinding forgings, castings and dies.


water coolant system is standard equipment

TYPICAL APPLICATIONS ■ Castings . . . eliminates milling or planing . . . requires less stock to be left on for finishing . . . as much as 1/16″ of stock can be saved on each surface. ■ Automobile Body Dies. ■ Plastics Molding Dies. ■ Molded Insulating Fire Brick. ■ Ceramic Insulators. ■ All types of Forging Dies. ■ WHEREVER FLAT, SQUARE SURFACES ARE REQUIRED.

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ACCURACY BOOSTS PRODUCTION

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MACHINE TOOL COMPANY
EAST PROVIDENCE, RHODE ISLAND

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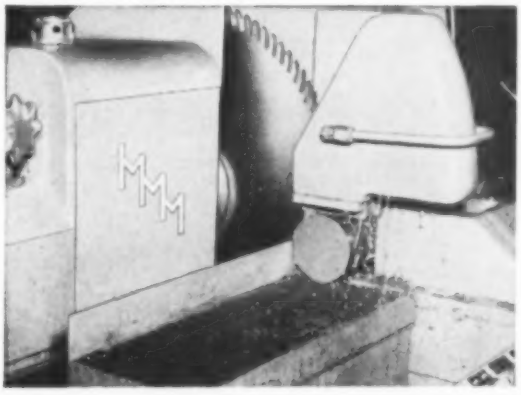
A "clean deal" with 3 MOTCH & MERRYWEATHER PRODUCTS

TRIPLE C GRINDING COOLANT

Transparent solutions; watch work progress. Soluble in water; no emulsifying action. Maximum cooling. Grinding wheels stay clean and free-cutting; minimum wear and dressing. No disposal problem. No slippery work-pieces. No foaming. Non-flammable. *No objectionable odor,* even in hottest weather.

TRIPLE C CUTTING COOLANT

Extreme pressure lubricity lengthens tool life. Transparent, water-soluble, non-oily, non-greasy. Non-gumming, non-galling, anti-rust, friction-reducing. Foamless, smokeless, vapor harmless, no skin infection; no fire hazard. Agreeable odor — *never foul.* A definite aid to production and accuracy.



Also TRIPLE C MACHINE CLEANER

A good coolant works best in a clean machine

Dissolves accumulated insolubles in coolant systems; cleans thoroughly at lowest labor costs. All Triple C advantages: Clean, Cool, Clear; safe, preventing bacteria at source. And *never a foul odor.* Your men will like it!

THE MOTCH & MERRYWEATHER MACHINERY CO.

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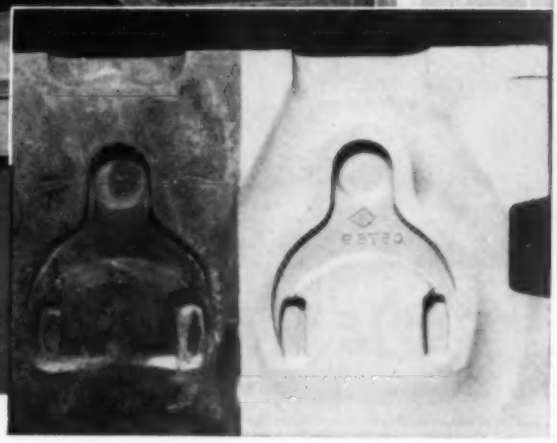
Above: Close-up of a blasting compartment, showing a large forging die in process of cleaning.



Right: Forging Die. One half before blast cleaning, other half after blast cleaning.

All photos courtesy Wheelabrator Corporation, manufacturers of LIQUAMATTE Wet Blasting Equipment.

Wet blasting with EXOLON *FASTBLAST* reduces costly hand finishing time 97 to 99%

EXOLON (aluminum oxide) abrasive in particles so small they can be suspended in a slurry, are thrown at high speed against the work to be finished. Scales, burrs, carbons, oxides and smeared metal are removed, exposing the virgin metal in a minute, non-directional matte finish.

The rate of finish is controlled by varying air pressure; abrasive size, type and concentration; blast angle and distance of nozzle from work. The abrasive mesh sizes usually are 150, 180, 220 and 240.

Wet blasting produces a chemically clean surface to which plating and other coatings adhere in a permanent bond. Hand finishing requiring 1 to 6 hours was reduced to 30 seconds to 10 minutes by Wet Blasting.

Our technical and research staff will be glad to assist on any problems in the use of EXOLON or CARBOLON.

The EXOLON Company

1002 East Niagara Street • Tonawanda, N. Y.

Thorold, Ontario, Canada

Manufacturers of SILICON CARBIDE and ALUMINUM OXIDE ABRASIVES

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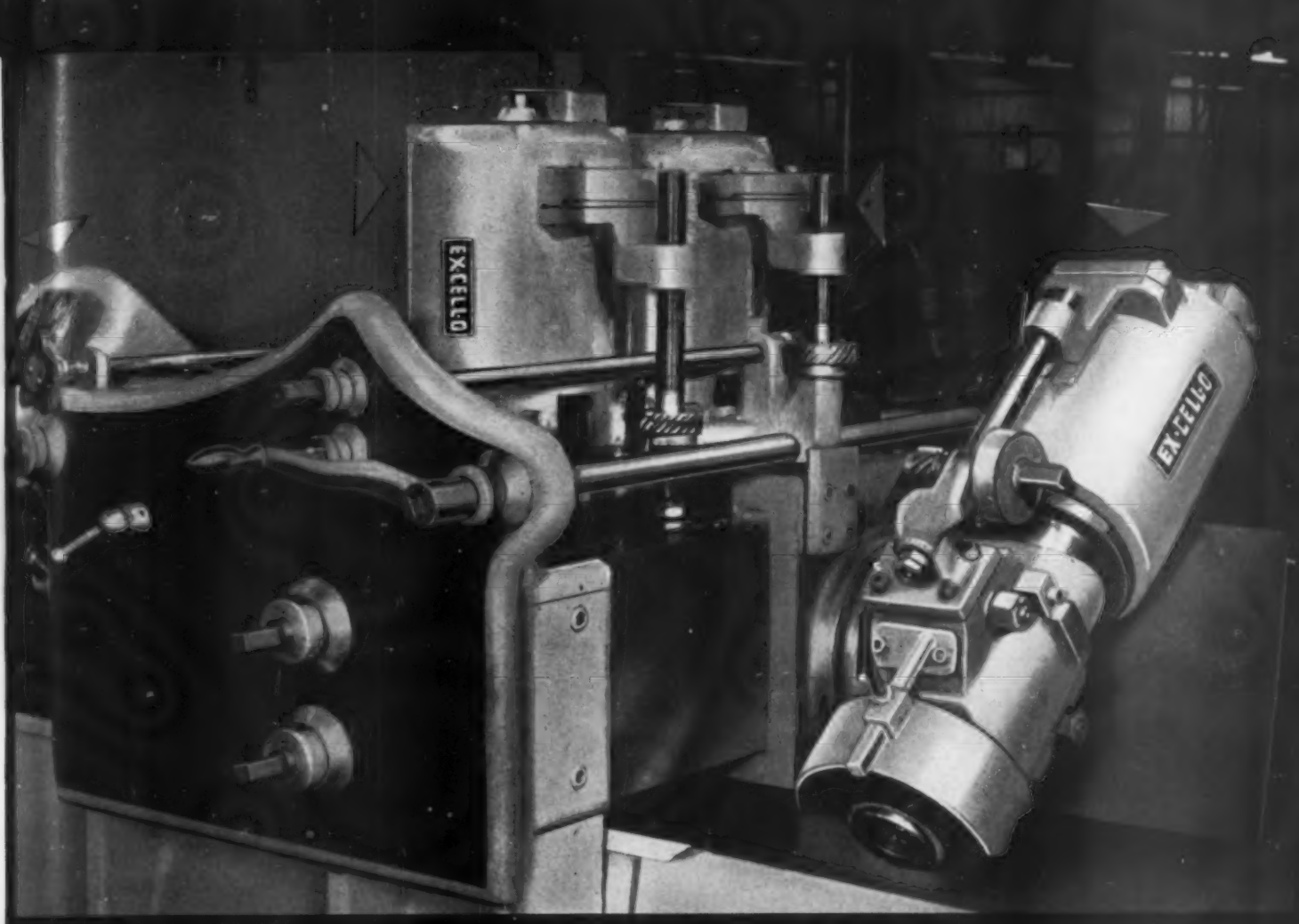

This Idea Multiplied Production by Two...

EX-CELL-O SPINDLES— AN INGENIOUS APPLICATION

A machinery builder in Kalamazoo, Michigan was faced with the problem of finish grinding both flat and angular dovetail ways on the column, knee and table of his vertical milling machines. Surface lengths varied from 9" to 24"; tolerances on flat and parallel measure had to be within .001" in 24". Workpieces were gray iron sand castings.

Conventional way to do the job—an oscillating surface grinder to work each dovetail separately. Production men thought they could improve on convention. They built up their own machine from an old planer bed, added a bridge to support four Ex-Cell-O Precision Spindles and retained the standard planer feed.

The result: grinding both sides of four dovetail surfaces in one-pass planer fashion for a saving of roughly 50 percent in per unit cost. Perhaps you too have an operation which could be performed more economically by an Ex-Cell-O Spindle; or perhaps you simply want to use the most versatile, dependable and long-lived spindle money can buy. In either case, you'll want to get in touch with your nearby Ex-Cell-O Representative, or contact Ex-Cell-O direct.

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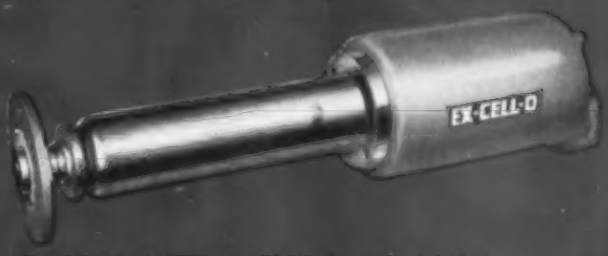
57-23

Above, four standard Ex-Cell-O Precision Grinding Spindles are utilized to grind four surfaces of machine ways in one pass.



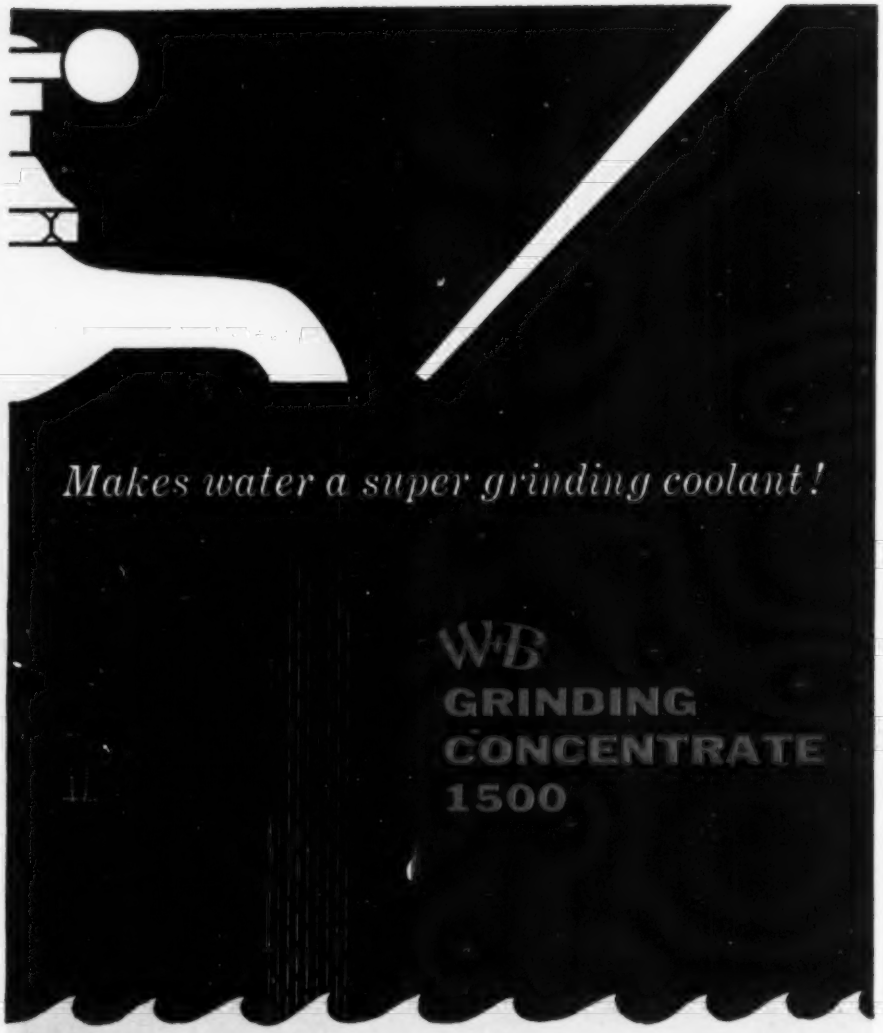
Standard, totally enclosed motorized surface grinder spindle is rated one horsepower at 3600 rpm. Also available in a range of higher horsepower.

XLO EX-CELL-O FOR PRECISION

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT



Here's a simple, economical way to turn water into an *all-around* superior grinding solution for ferrous metals and titanium! For ferrous metals, just mix 1 part W&B Grinding Concentrate 1500 with 150 parts of water. You'll get a low-cost, transparent mix that really keeps wheels open . . . settles chips instantly. Provides excellent rust protection and freedom from foam too. Grinding is keener . . . machines stay cleaner. Get complete information on this outstanding grinding concentrate. Fill out and return attached coupon.

W&B Grinding Concentrate 1500 is being used by many of the country's largest manufacturers.

W&B INDUSTRIAL LUBRICANTS

THE WHITE & BAGLEY CO.

Worcester, Massachusetts • Detroit, Michigan

Originators of Grinding Lubricants

THE WHITE & BAGLEY CO., 88 Foster St., Worcester, Mass.

Please send me complete information on W&B Grinding Concentrate 1500 — and the list of large users.

Name ..... **Title** .....

Company ..... **Street** .....

City ..... **Zone** ..... **State** .....

☐ My plant has a tricky grinding problem on which we'd like advice. I've attached a letter describing it in detail. I understand that you offer this service without obligation.

Use postpaid card. Circle No. 211

Letters

continued

and appreciate the valuable information which it brings to us each month.

R. S. S.
Springfield, Ohio

What you're probably looking for is Minnesota Mining and Manufacturing "Ceramicones," which is a magnesia silicate ceramic medium. This is used with an aluminum oxide abrasive powder or compound for most applications, the ceramic cones serving to bring the aluminum oxide against the workpiece.

Blanchard Grinding of Titanium

Do you have any literature for the Blanchard grinding of titanium? We would appreciate any you might have. Thank you.

R. R.
Bridgeport, Connecticut

We're told that Watertown Arsenal is grinding titanium using a white aluminum oxide wheel. Blanchard Machine Company is reported grinding titanium with a silicon carbide wheel. Another firm in South Bend, Indiana, uses a 9A100HB wheel for finish grinding a ring of titanium 14 inches OD x 1 inch wide, and getting a finish of about 15 microinch. As a starting recommendation, Blanchard suggests first a resinoid bonded wheel using either silicon carbide abrasive or the white refined form of aluminum oxide abrasive. The grade of the wheel should be very close to the grade of their wheel used for an equal surface of cast iron. We suggest that you contact Blanchard Machine Co., Cambridge, Mass., for further help.

Industry Observer

With foundry and steel mill snagging jobs coming in for close scrutiny from the cost angle, the editors are glad to present the fine article on snagging wheel testing by A. S. Wyborski in this issue. Indications are that billet and casting snagging are being studied very closely by all major metalworking industries. So far, the cost reduction push has paid off with semi-automatic billet

(continued page 20)

"Tumblex* 'T' has a definite place in our tumbling department"...

Leading pump manufacturer lists benefits gained from Norton ALUNDUM TUMBLEX 'T' abrasive*

The executive we're quoting based his decision on parts difficult to deburr with his previous tumbling abrasive. Test runs with Tumblex "T" abrasive, the new Norton bonded, triangular shaped tumbling abrasive, gave him these results:

Part A — 100% increase in barrel payload and 80% reduction in tumbling time. A sandblast operation eliminated and hand deburring reduced about 75%.

Part B — Barrel production increased 20%, tumbling time reduced 25%.

Part C — Barrel production increased 25%, tumbling time reduced 50%.

Part D — Sixteen hours hand deburring saved per 1000 parts.

Tumblex "T" abrasive is one of the most revolutionary tumbling abrasives ever developed. Everything about it is designed for better barrel finishing.

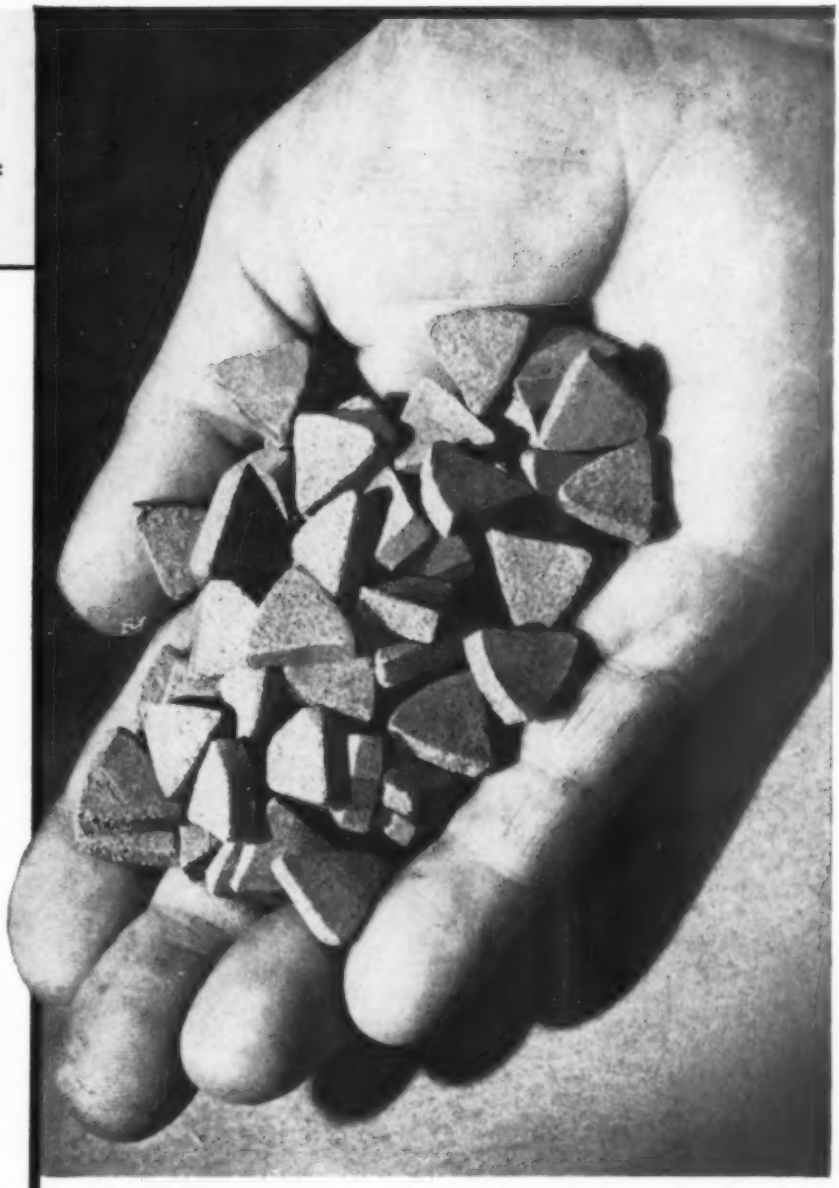
Its uniform triangular shape and size prevents wedging in recesses . . . Made of famous bonded ALUNDUM abrasive, it cuts fast, with no cutting compound needed . . . It provides maximum surface contact with parts being processed, for shorter cycles and larger payloads . . . It wears evenly, and when worn down can be used on parts requiring a smaller abrasive . . . Its lightness means less weight required to fill the barrel.

Results are more uniform finish, shorter time cycles and lower costs per piece finished.

Send For Work Samples

to our Sample Processing Department. Let us prove to you how the latest barrel finishing equipment and techniques can add the "Touch of Gold" that improves product quality and cuts finishing time and costs. NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

G-315



TUMBLEX "T" ABRASIVE brings three big advantages to barrel-finishing: non-wedging triangular shape; fast-cutting bonded ALUNDUM abrasive; long, even wear. Especially effective on intricate-shaped parts. Available in four sizes.

NORTON
ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

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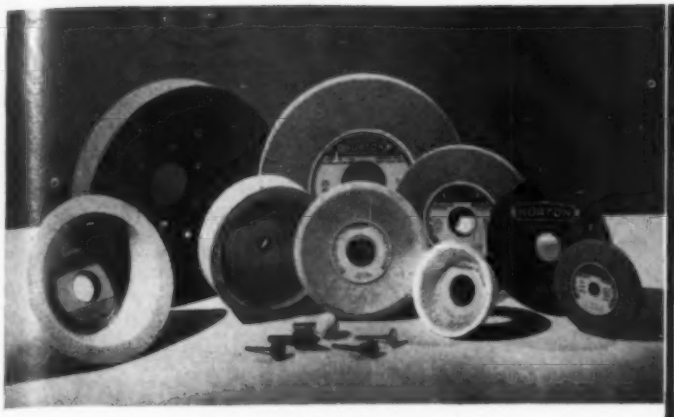
Here's your SUPER-MARKET for tool room grinding wheels

Norton makes wheels for every tool room job... precision-built for "TOUCH OF GOLD" uniformity

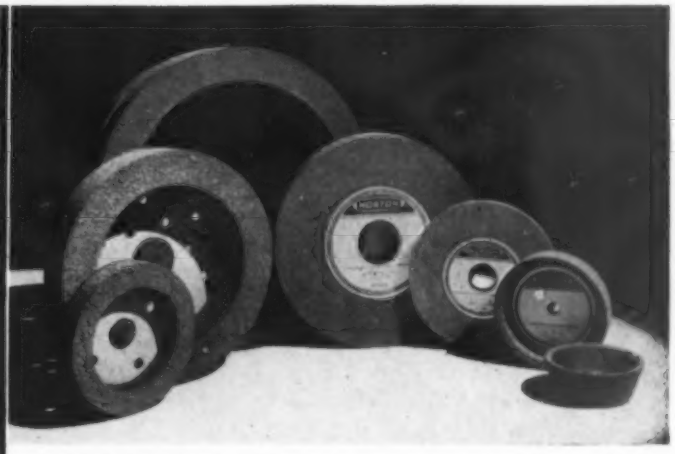
"Everything under one roof."

That's the modern super-market advantage Norton brings to your tool room grinding operations.

In the Norton line — the world's largest — you'll find a type and size of wheel, in just the right abrasive and bond, for best results on every tool room grinding job you do.



NORTON G BOND AND BE BOND WHEELS bring you the most efficient vitrified bonds ever developed for precision and semi-precision grinding. For sharpening and for surface, cylindrical and internal grinding on all steels and cast alloys use G Bond or BE Bond Wheels in either 32 ALUNDUM*, 38 ALUNDUM, 19 ALUNDUM, or the new non-premium priced 44 ALUNDUM abrasive.



NORTON K BOND WHEELS in CRYSTOLON* abrasive are the best investment for many carbide grinding jobs. The vitrified K Bond comes in half-grade increments of hardness, enabling you to "pin-point" your specifications. K Bond CRYSTOLON wheels are also excellent for grinding cast iron and other low tensile strength materials.

NORTON DIAMOND WHEELS are the recognized "Crown Jewels" for carbide grinding — backed by long leadership in diamond wheel development and manufacture. For wet grinding carbide tools use them in the regular B resinoid bond — for dry grinding the B6 resinoid bond is recommended.

TWO BOOKLETS THAT TELL YOU ALL. *The Handbook on Tool Room Grinding* is over 200 pages long and crammed with information that will be helpful to you. *How To Select Wheels For Precision Grinding Tool And Constructional Steels* shows the way to correct wheel selection. Get these from your Norton Distributor or write to the nearest District Office of Norton Company, Worcester 6, Massachusetts.

Top performance is the common denominator

Norton wheels, all of them, are made on the most advanced equipment and with the most experienced "know-how" in abrasives manufacture. The result is processing so precise that it can't miss — it brings you new standards of wheel balance and duplication of grinding action.

To you, this means wheel after wheel and lot after lot will grind alike — with the same time-and-money-saving "Touch of Gold" performance.

As a manufacturer of grinding machines as well as grinding wheels, Norton knows how to build wheels exactly to machine requirements — and offers you the longest experience in both to help you produce more at lower cost. For aid in wheel selection, and for helpful booklets on tool room operations, see your Norton Distributor. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. Behr-Manning Company, Troy, N. Y. division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated. **For the booklets or other information write to Norton Company, Worcester 6, Mass.**

NORTON

ABRASIVES

Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes

W-1759

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

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Unequalled barrel finishing ...with 4 different TUMBLEX* abrasives

Here are vital steps that will give you exactly the results you're looking for on deburring, descaling and finishing your products.

One is to switch from out-of-date tumbling or off-hand methods.

The other is to check Norton Tumblex materials and learn which, together with modern barrel finishing techniques, make the best combination to meet your particular requirements.

The long, expert experience of Norton engineers in developing Tumblex abrasives has brought the value-adding, cost-cutting "Touch of Gold" to barrel finishing of the widest range of products. To you, this means prompt aid in solving finishing problems. Just send sample parts, ranging from tiny needles to hefty forgings, to the Norton Sample Processing Department. You'll get helpful recommendations as to the type and size of Tumblex material to use — plus other data on the tumbling barrel equipment and operating methods you need most. **Or write, to Norton Company, Worcester 6, Mass.** for a copy of the newly revised handbook on barrel finishing. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

G-323

ALUNDUM* Tumblex "S". Newly developed bonded spheres that easily get into areas where other abrasive shapes can't reach. Exceptionally dense and long lasting, for top barrel finishing in many applications. In five different sizes.

ALUNDUM Tumblex "T". Bonded, triangular shape, and fast cutting for special shaped parts. Triangular form prevents wedging in work slots or holes. Available in four sizes.

ALUNDUM Tumblex "A". The workhorse for general barrel finishing. Performs several operations at once, removing flash, scale, tool marks and burrs, while forming radii and finishes to required microinch. Made in eleven sizes.

Tumblex "N". Natural stones, offered exclusively by Norton, for high lustre, especially on die castings and soft metal. Rounded uniform shape brings out the most desirable color of finished parts. In seven sizes.

NORTON
ABRASIVES

Making better products... to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives
Sharpening Stones • Behr-cat Tapes

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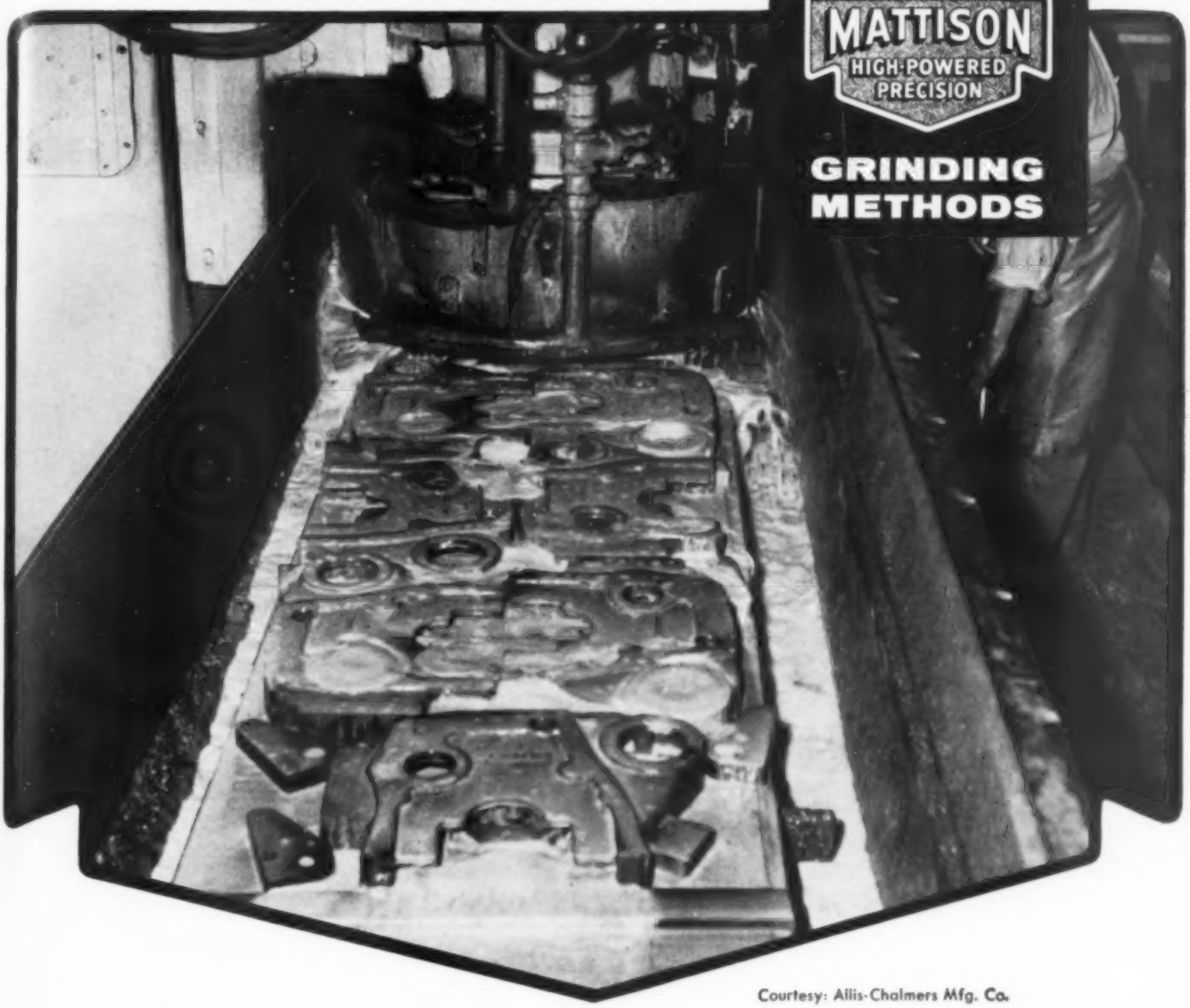
CASE HISTORY NO. 37—TIMING GEAR HOUSINGS

MATTISON HIGH-POWERED PRECISION

GRINDING METHODS



Courtesy: Allis-Chalmers Mfg. Co.

Bigger loads, faster setup on surface grinder doubles production of parts formerly milled!

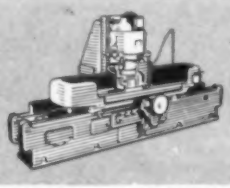
Production was boosted from 5 to 12 parts per hour by switching this job to a Mattison No. "400-SS" Vertical Spindle Reciprocating Table Surface Grinder. The workpiece is a diesel engine timing gear housing that is first rough-ground to within .010 inch on both sides and then finish-ground on the same machine. Flatness and dimensional tolerances are easily maintained within commercial limits.

Practical elimination of setup time is a big item in getting this increased production. Most parts have only to be laid flat on the magnetic table, fixtures are not needed in most cases. Seven castings, like those shown, can be finished at one time.

An extra-long and heavy column, rigidly fastened to the base, and a 60, 75, or 100 hp spindle motor are features which speed metal removal and increase accuracy on the Mattison 400 Series Vertical Spindle Surface Grinder. Arrange for a test grind on your parts in the Mattison Methods Laboratory.

Shaded portion of timing gear housings, at left, is removed in two-pass setup on Mattison 400-SS grinder. Finished workpieces are at right.

MATTISON MACHINE WORKS ROCKFORD ILL. U.S.A.



HIGH-POWERED PRECISION SURFACE GRINDERS

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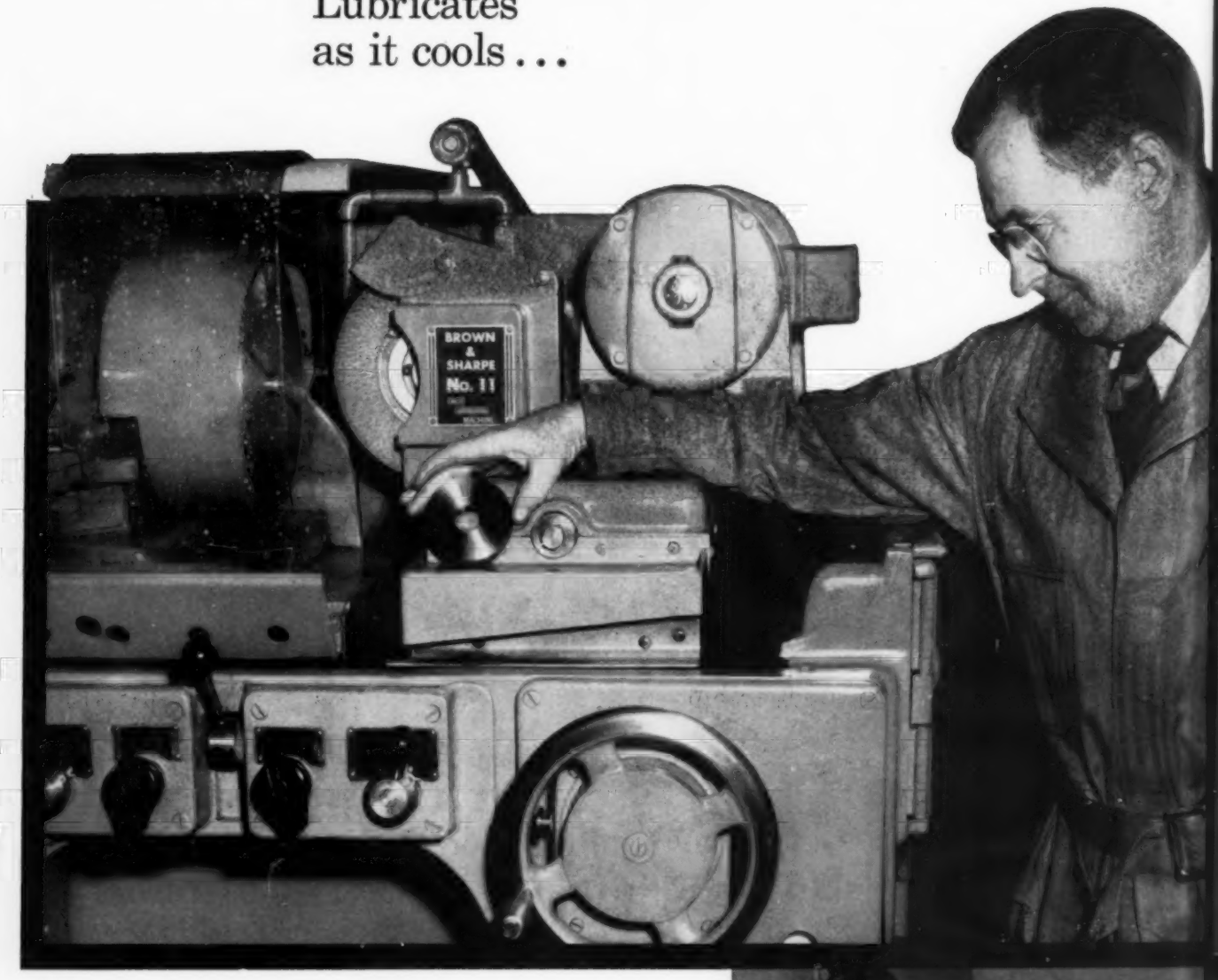
CODOL

LIQUID GRINDING COMPOUND

Lubricates
as it cools . . .



CODOL controls rust, keeps grinding wheels clean

The steel disc, above, is ground on a B & S No. 11 face grinder, holding .0001 in. flatness tolerance and three to four microinch finish. Stuart's Codol Liquid Grinding Compound leaves a fine film of oil on precision-ground surfaces, prevents oxidation, and eliminates a cleaning problem. Lubrication at the point of contact between wheel and work reduces friction . . . prevents wheel loading . . . eliminates heat stresses and surface checking.

With Codol's extra detergency, lubricity, and cooling qualities, you can hedge against high maintenance and operating costs . . . assure maximum profit return through higher quality work at lower over-all cost.

The fine finish and accuracy built into a Brown & Sharpe grinder is ground *on* a Brown & Sharpe grinder . . . with the help of Stuart's Codol Liquid Grinding Compound! Pioneer in precision since 1833, this company recognizes the importance of all three major functions of a grinding compound: (1) lubrication to prevent generation of excess heat, (2) cooling capacity to dissipate heat rapidly, and (3) balanced surface tension to flush chips away from the wheel and work.

Codol's premium-quality petroleum base provides the high lubricity needed for applying high unit pressures made possible by modern grinding machines and wheels . . . lubricity which eliminates heat stresses and is so essential to accuracy, finish, and wheel economy. Codol's carefully balanced surface tension flushes chips away from the wheel and work . . . prevents wheel loading, heat distortion, and surface checking.

Don't sell grinding fluids short when you are looking for "tenths" in accuracy . . . for smooth ground surfaces which are not work-hardened . . . for maximum wheel life . . . and for rust protection for machine parts, tooling, and work. Take the lead of this precision machine-tool builder, a company that knows how to get peak performance from grinders!

Helps Brown & Sharpe Mfg. Co. produce fine finish precision parts at minimum wheel cost!

Steel motor shafts are held to .0005 in., grinding 100 pieces per hour on a Brown & Sharpe No. 12 plain cylindrical grinder. Stuart's Codol liquid grinding compound is used in more than 100 different grinding machines in this Providence, R. I., plant.

Brown & Sharpe No. 1 universal grinder finishes 45 deg angle on machine-tool rollers at the rate of 200 per hour. Accuracy is held to .0003 in. Codol keeps wheel open and chips flushed away to produce finishes as fine as six microinches, rms.

Phone your
Stuart Service Center

Arrange now to test Stuart's Codol on your difficult precision grinding jobs.

DETROIT, MICH.	Tyler 7-8500
CHICAGO, ILL.	Bishop 7-7100
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METALWORKING LUBRICANTS

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clear
transparent

K-7

NEVER LOADS THE WHEELS

K-7 solutions do not load work wheels, and this important advantage means (1) fewer dressings, (2) longer wheel life and (3) a true ground finish (rather than a burnished or smeared finish). In addition, with K-7 (because it does not load) you can often use a harder (1-2 grades) and finer (10-20 points) grit wheel, resulting in better work at lower cost.

Investigate K-7 for use in grinding all steels, cast and malleable irons, titanium, carbon, rubber, ceramics and plastics. (Not recommended for non-ferrous metals.) It is an all-chemical water soluble liquid concentrate, transparent and colorless in solution. It is non-foaming and runs absolutely flat under all conditions. Low pH (alkalinity) makes it easy on the skin. Send for details.

CONCENTRATION TEST KIT

With this pocket size Concentration Test Kit K-7 users can check the concentration of the solution right at the machine. Only takes a minute or two.

THE Lusol.. LINE
BETTER PRODUCTS FOR BETTER METALWORKING

F. E. ANDERSON OIL COMPANY INC.
BOX 218, PORTLAND, CONNECTICUT

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Observer

continued

grinders for the steel industry (See GRINDING AND FINISHING, December, 1956, p. 46) and we've little doubt that there are advances of a similar nature ahead in general foundry snagging.

There's excitement ahead in abrasive methods. Like many other technologies, abrasive processing developments seem to come in spurts. We're sure you won't want to miss the word on new techniques to be reported soon in GRINDING AND FINISHING.

Business is pretty good, isn't it? GRINDING AND FINISHING editors in field trips in recent weeks haven't found, firsthand, any of the general business pessimism that has been widely reported. A little breathing spell, maybe, but no general softening. Most people we've talked to say that January and February orders ran well ahead of the corresponding 1956 period.

49,000 cylindrical grinders now in use in this country can economically use automatic size-control gaging equipment, according to one manufacturer of such equipment as reported in Electronics magazine's business edition.

Now we're going after tenths of millionths of an inch in gaging. A joint government-industry project aimed at making such accuracies possible has been announced. A. M. Dexter, Pratt & Whitney gage research director, has been sent by his company to the National Bureau of Standards to participate in the big push on the "infinitesimal barrier." Chief of the project is Dr. Irvine C. Gardner, head of the Optics and Metrology Division of the Bureau of Standards. Many research studies must be made to gain this further foothold in gaging accuracy, demanded mainly by aircraft and missile builders.

"Here, let ME taste that coolant!"

CORTLAND SNAGGING WHEELS

Cortland is good business for you, too

From our front lawn you'll look up into the surrounding hills, tree-covered except where the rocky walls rise sheer and stark. Freight cars on our siding and trailer trucks at our shipping platforms, are loading for Springfield and the East — Albany and the West.

Business is good here in Chester, Massachusetts because so many manufacturers have found that Cortland Grinding Wheels are best by test. You see, there's a lot of "know-how" required to make a good wheel. It starts with specifications based on the job you want to do. It develops in the laboratory, mixing rooms, press rooms, ovens, kilns, finishing machines, and in marking, packing and shipping. Men and women have a lot to do with it — people who have made Cortland Grinding Wheels a living symbol of New England Craftsmanship.

Come up and see us sometime!

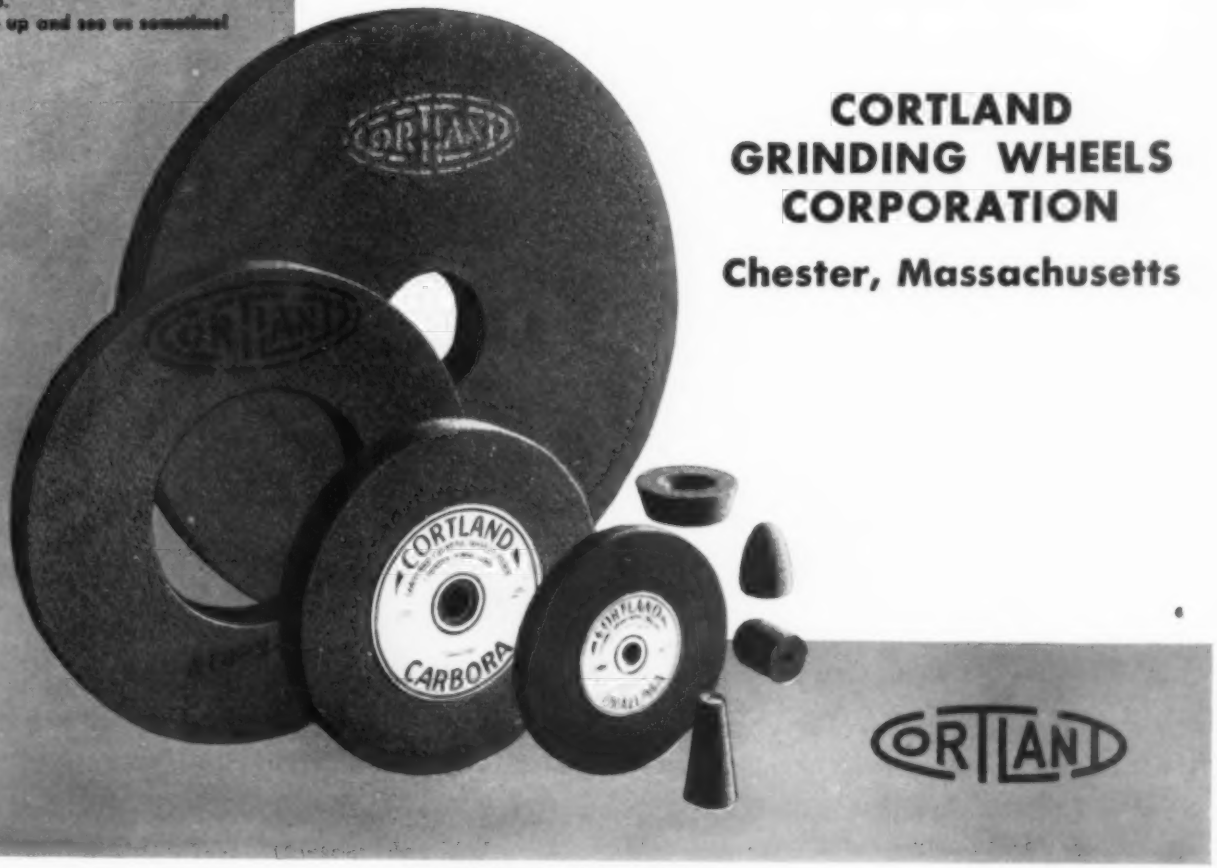
You, too, can prove them "Best by Test" on castings, forgings, billets and weldments

Snagging is one job where you want results *fast.*

Customers have found that it pays to install Cortland engineered Snagging Wheels, Cones, Cups.... The operators turn out better work because the cuts are fast, cool — and always *right* for the job. "Down-time" is reduced — the wheels last longer, because the abrasive, grain size, grade, structure and bond were all specified to give best possible performance.

You, too, can prove Cortland Snagging Wheels "Best by Test" on your swing frames, stand grinders and portables. Cortland's Oxaluma (aluminum oxide) and Carbora (silicon carbide), in Vitrified and Resinoid bonds, can be developed for you in all standard wheels and in special shapes to meet your snagging needs.

Let the Cortland Man help you —
he knows his business: *better grinding.*



CORTLAND GRINDING WHEELS CORPORATION

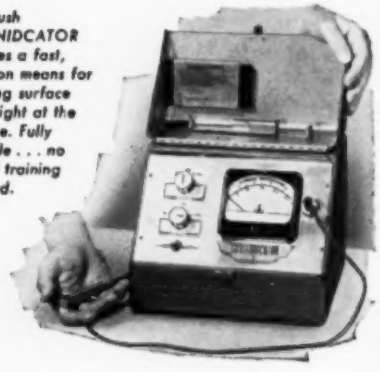
Chester, Massachusetts

Use postpaid card. Circle No. 215

How much profit is machined out of your product?

Whenever your product is finished one micro-inch more than specified, profit is actually machined away. In the past, this waste was due to the machinist's inability to accurately judge how far he had progressed in his surface finishing operations.

This situation need not exist today. Brush has developed a remarkable new tool, the Brush SURFINDICATOR*, that can be used by anyone to accurately measure surface finish on metal, paper, wood, plastic—*any* material.



The Brush SURFINIDCATOR provides a fast, precision means for checking surface finish right at the machine. Fully portable . . . no special training required.

Here's how profit can be protected

The SURFINDICATOR measures surface finish to within one micro-inch providing a direct reading in accordance with new industrial and military standards. A hand-held stylus is simply stroked over the surface to be measured and the reading taken—no special training is required. The entire SURFINDICATOR is completely portable and permits the machine operator to finish a surface to exact specifications—no more, no less—no wasted machine time, no rejects.

And, to permit accurate re-calibration in the field, precision reference specimens are supplied with every instrument. These specimens, exclusive with Brush, are the ASA approved precision reference standards for surface finish measurement.

SURFINDICATOR booklet contains new ASA standards and complete details on cost-saving finish measurement . . . New Surface Finish Control Efficiency Study can be made on your production line.

The complete story on how the SURFINDICATOR prevents overfinishing, protects your profits, can be obtained on request. A Surface Finish Control Efficiency Study form is also available to aid in evaluating finishing cost efficiency in your plant. Write for both the SURFINDICATOR booklet and the Efficiency Study form today. *T. M.

BRUSH ELECTRONICS COMPANY

3509 Perkins Avenue, Cleveland 14, Ohio

BRUSH ELECTRONICS

DIVISION OF CLEVITE CORPORATION

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NOW for heavy duty grinding . . .

you can have the fast cutting action of a softer grade with long life of a hard wheel

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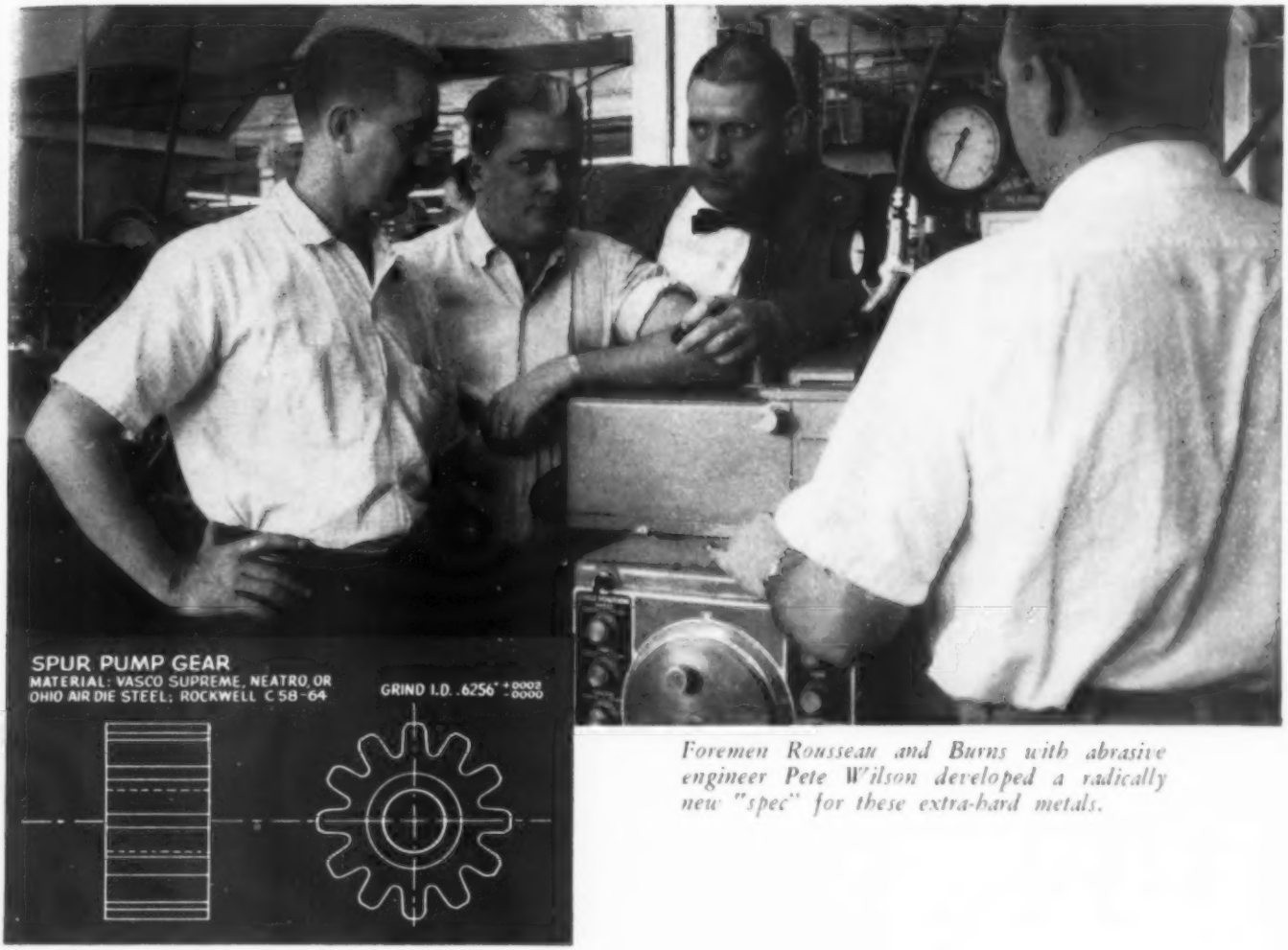

Foremen Rousseau and Burns with abrasive engineer Pete Wilson developed a radically new "spec" for these extra-hard metals.

A GRINDING PROGRESS REPORT

Extra Fine Grit Silicon Carbide Succeeds In Tough Vasco Supreme I. D. Grinding Job.

Finer grits and "softer" wheels are the usual approach to grinding hard metals. This was not enough, however, on the hardened die steels required at the W. H. Nichols Co., Waltham, Mass. Wheels soft enough to cut, with the limited pressure of internal grinding, were too soft to hold shape.

Recommended: Silicon Carbide grain, for better penetration into these metals of high carbide content, and grits much finer than the normal 90, to take smaller chips but more of them.

Results: Using 240 grit on the Vasco Supreme, and 150 on the Neatro and Ohio Air Die steels brought about both the quality and quantity of production desired. With wheel dressing reduced to 1/8 the amount formerly required, 50 or more pieces are now completed per wheel.

These results are typical of Bay State. You can get them through your local distributor, any branch office, or the Bay State Abrasive Products Co., Westboro, Massachusetts.

Branch offices are located in Bristol, Conn., Chicago, Ill., Cleveland, Ohio, Detroit, Mich., Pittsburgh, Pa., with distributors in all principal cities.

Slender spindle and large contact area limit infeed pressure, making wheel selection critical on hard, abrasion resistant metals.

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- **corrects out-of-roundness**
- **applies selected finish**

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232 brake drums per hour, holding 80 to 100 RMS finish.

BarnesdriL Special Blind-End Honing Tool with Adjusting Head utilizing Plas-T-Clad stones.

For the first time it is possible to remove taper, correct out-of-roundness and apply a honed finish, all in one operation. The honing tool that does all these things has been developed by BarnesdriL engineers, specifically for a brake drum manufacturer.

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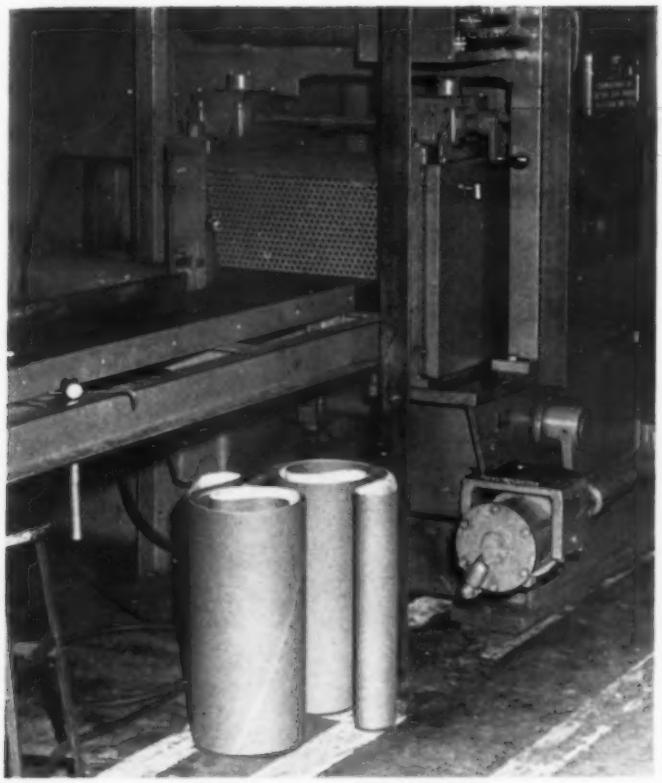
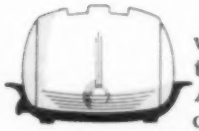


SUNBEAM Corporation finds...

Pre-finishing with 3M Abrasive Belts cuts appliance finishing costs



In the Chicago plant of this world-famous appliance manufacturer, 3M "Production" Resinite Abrasive Belts are used to pre-finish cold rolled sheet steel for toaster shells (picture at left, above). The company finds that by using a series of grits they can remove pits and surface imperfections in the steel—drastically reduce the subsequent finishing operations after stamping and forming of the toasters. Each 3M Belt finishes an average of 200 18⅜" x 96" steel sheets.

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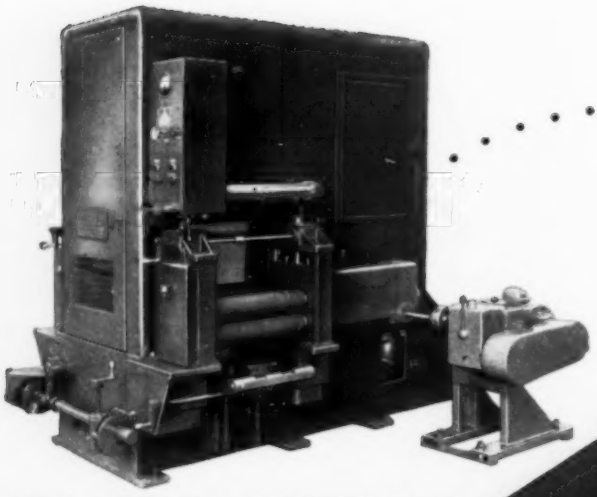

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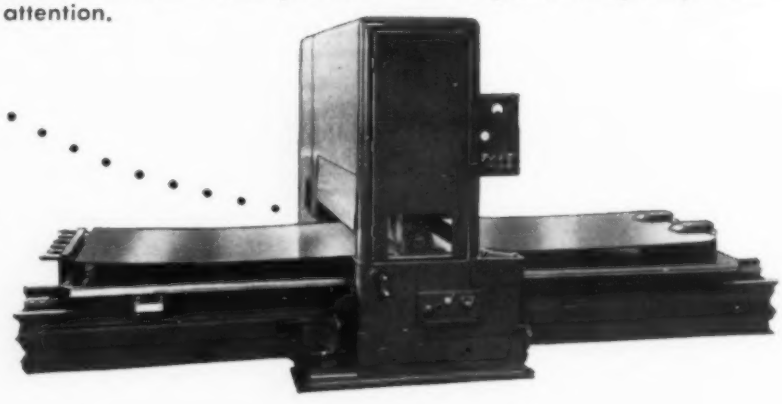

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Grinding and Finishing

Editor's Page

A New Society Is Born

When a group of responsible men gather together and give unselfishly of their time and effort to found a society with the lofty aim of furthering the progress of an industry and the men and women connected with it, the birth of the society merits our sincerest esteem. The founders of the American Society for Abrasives have launched a venture which will be successful only in direct relation to its unselfish aims. Success for a society, as it is with all generous undertakings, is not fashioned nimbly and lightly but must be hewn out of solid granite with herculean muscles. Alas, were there but an easier way! Prejudice, selfishness, little thoughts and mediocrity are ever chipping and gnawing and boring away on a noble cause. Measure these monsters as hardy, first-line battalions which can be beaten to earth with intelligence, high purpose and unflinching determination to adhere to unselfish resolutions.

GRINDING AND FINISHING salutes the debut of the American Society for Abrasives.

The attitude of a magazine serving the same industry as a society should be entirely objective, reporting the aims, activities and accomplishments of the society as long as these are newsworthy. Further, a magazine should extend its moral support as well as hold out a helping hand to any enterprise which contributes to the growth of the industry and its members and which keeps faith with its avowed selfless purposes. It is one of the laws of life, for associations no less than for magazines: Success is measured in terms of service.

The aims of the new society are ". . . to hold meetings for technical discussions of all phases of the use, manufacture and improvement of abrasives, to create good fellowship among the members and facilitate the exchange of knowledge gained from practical experience."

These are splendid aims, sound and good, and GRINDING AND FINISHING suggests that its readers who use grinding wheels, machines and abrasives look into the matter.

GRINDING AND FINISHING is NOT the official organ of the American Society for Abrasives, nor is it contemplated by us that we become so. It has no financial interest in the new venture. However, GRINDING AND FINISHING will disseminate news about the society, publish its meeting notices and its technical discussions, as long as the society serves the abrasive industry and treasures its unselfish duty to the members of the industry. If invited, it will lend its counsel at the council table, being, however, ever mindful of its foremost obligation, service to its readers.

So, to the new American Society for Abrasives, God-Speed, Good Luck, and above all, Stout Courage!

Wm. J. Schleicher

Editor

Grinding and Finishing
APRIL 1957

How to Reduce Snagging Costs

by **A. S. Wyborski**
Manager of Sales Engineering
Peninsular Grinding Wheel Company

● A properly planned and executed grinding wheel testing program is the key to important cost reductions in foundry and steel mill snagging operations. A good comparative testing program will take into account all variables and eliminate them from tests. It will lead to true cost comparisons of the wheels tested, and to the best vendor sources for purchasing.

The practice of testing grinding wheels in steel mills and foundries has grown in importance in recent years. Most users of snagging wheels select their suppliers and allocate their purchases according to the relative performance of the vendors' wheels. These performance or efficiency levels are determined by grinding wheel tests in which an order of superiority is assigned to the competing wheels according to their ability to give the lowest grinding cost per unit of work produced. Thus, because they influence such important decisions as selection of vendors, who in turn determine the economy of the operation, grinding wheel tests have assumed a position of major importance to the user as well as the vendor. To the user, tests are a means to gauge his production costs. To the vendor, they are a means by which he can demonstrate the merits and advantages of his product. They are also the only dependable means available to the user to evaluate the economy realized from a lower-priced product versus the higher-priced products capable of a superior performance.

It's obvious that grinding wheel tests must be conducted to provide true results. While most major users have established sound procedures for their tests, there still remain a few who base major purchasing decisions on trials in which chance is the dominant factor. They haven't yet grasped the idea that a test which is not reproducible cannot be considered definitive. Further, they do not share the basic creed of the informed testing engineer—that the test must be free of all variables except those in the products being compared.

In nearly all grinding operations, but particularly in snagging, there is an ever-changing constellation of varying forces and factors which greatly influence the outcome of a grinding wheel test. If these forces and factors were present constantly and to about the same degree, or if they exerted their influence in the same direction, they wouldn't be so exasperatingly troublesome to the testing engineer. But because they are ever-changing, in degree as well as direction, their effects cannot be predicted or tolerated. At times they may offset and neutralize each other. At other times they may be additive—either in a favorable way so as to enhance the performance of a given wheel, or in an unfavorable way which would detract from its true performance.

Thus in any grinding wheel test the conditions can be average, which is highly desirable, or favorable to varying degrees, or unfavor-

At last, a realistic approach to the problem of high snagging wheel costs. The answer: a good comparative testing procedure for wheels. The author tells:

What the job variables are—in men, machines and materials
How to eliminate these variables in snagging wheel tests
How to evaluate test results
How to arrive at true cost comparisons
How to pick grinding wheel vendors

by Proper Wheel Testing

able to varying degrees.

In snagging operations, this variation can be very substantial—in fact, so great that it becomes the dominant factor in the test. Testing under these conditions is pointless and is, in effect, nothing more than a game of chance. In these instances the errors in the test results are often greater than the actual difference in the qualities of the wheels being compared.

The size of this effect can be readily demonstrated by subjecting two groups of wheels, which have previously been proven of equal quality, to a snagging test in which the major variables are not controlled. In such a test, differences of more than 50% would be experienced. Under controlled conditions, with the major variables averaged or neutralized, the results of the same two groups would be statistically identical and the pattern of individual wheel performances would likely follow the standard probability curve.

There is ample evidence that testing under conditions in which the variables are not adequately controlled will usually provide deceptive results. And that any test which is incapable of repeating itself cannot be considered definitive or conclusive.

Variables in Snagging Jobs

The major variables in swing frame or floor stand snagging operations are threefold:

1.) The human element

"Wheel durability is often overemphasized. A true measure of wheel life isn't how long it lasted, but how many units of work it produced."

U.S. Steel Photo

TABLE 1

	OPERATOR A		OPERATOR B	
	Contact Hours	Lbs. Metal Removed	Contact Hours	Lbs. Metal Removed
	9.0	442	7.8	343
	9.6	382	7.0	287
	8.7	374	7.6	318
	8.9	436	8.4	322
	9.4	395	9.3	354
	9.0	357	7.5	326
	9.9	411	9.6	316
	8.1	401	10.2	348
	9.3	443	9.0	327
	8.8	385	9.6	330
Total	90.7	4026	86.0	3271
Average:	9.1	402.6	8.6	327.1

TABLE 1. PERFORMANCE DIFFERENCES turned in by two operators who used wheels of the same specification while grinding material of the same analysis and surface condition. Operator A is more efficient on two counts: He removed 23% more pounds of metal, and his rate of cut was 16.3% faster than that of operator B. The artificial effect on test results is obvious.

How to Reduce Snagging Costs

2.) The machine

3.) The material being ground

One variable introduced by the operator is the pressure he exerts on the wheel-work interface. The pressure may be high enough to cause rapid wheel breakdown and fast metal removal, or it may be low so as to result in slow removal accompanied by long wheel life. Another operator variable is the tempo at which he works. It varies considerably from day to day and between the first and second half of his working day. Some operators customarily get longer wheel life than their neighbors. Others seem to gain notoriety for their ability to "butcher" a wheel—to wear it out in an abnormally short time without producing a correspondingly higher number of work units in that time. To keep the human element variable to a minimum, it's essential to use the same group of operators to the same degree on each of the samples involved in a test. Table 1 shows how extreme the operator differences can be.

The variables contributed by the machine are mainly impact stresses on the wheel face. These are at a minimum in a machine relatively free of vibration, thus avoiding the premature fracture of the exposed abrasive grains as well as their being dislodged from their seats before they are completely spent. Conversely, a machine plagued with a lot of vibration will cause premature and wasteful fracture of the abrasive grains. Result: abnormally high rate of wheel wear. Among sources of vibration in the machine are worn bearings or spindle, undersized mounting arbors, unstable foundations, improper work beds and out-of-balance wheels. When vibration is of high amplitude and low frequency it is readily apparent. At other times, when it is of very low amplitude and high frequency, it is difficult to detect without instruments. But detectable or not, vibration is a highly destructive force and is a serious deterrent to a given grinding wheel's performance. Without proper safeguards, a poorly conducted test is apt to reflect differences in machine condition more than differences in wheel quality.

Equally significant are the variables resulting from the material ground. The abrasion resistance of alloy steels varies greatly, affecting the rate of dulling of the abrasive grains exposed in the wheel periphery. Aside from this physical aspect, certain metals have a pronounced effect on the rate of dulling of the abrasive grains due to chemical reaction at high temper-

TABLE 2

	Machine No. 2	Machine No. 9
No. of Wheels	11	13
Total Hours	58.0	53.6
Average Hours per Wheel	5.27	4.12
Total Lbs. Removed	6391	5720
Average Lbs. Removed per Wheel	572	440
Average Lbs. Removed per Hour	113	107

TABLE 2. MACHINE VARIATIONS can cause bad test results like these. They were obtained using wheels of the same specification on two different machines of the mechanical type in which the operator exerts virtually no influence on wheel performance. The stainless steel slabs ground in this test were selected for uniformity, and grinding pressures and rates of traverse were set identical. Since test wheels were known to be of equal quality, differences in data are directly attributable to machines. Rate of cut differed only slightly. Due to better condition and stability, wheels on No. 2 gave better wheel life.

atures. Titanium alloys are a dramatic example. In grinding 18-8 stainless billets with a manually operated swing frame machine, a ratio of metal removed to wheel consumed (in lbs.) of 8 to 1 isn't considered exceptional. But when grinding a titanium billet similar dimensions with the same machine, a ratio of 1 to 1 would be considered unusually good. While this comparison is an extreme one, and it is unlikely that any user would aimlessly intermix titanium alloys with stainless steels in a grinding wheel test, violations much less flagrant can upset an otherwise good test. For example, the grinding characteristics of type 316 stainless are much different from those of type 302, and the contrast between types 302 and 430 is also pronounced. A random mixture of these types of steel in a grinding wheel test would probably give contradictory data.

Other contributing variables from the material ground are the condition and density of the surface, which are largely dependent on the extent and method by which the material has been worked in preceding operations.

How to Minimize the Variables

In summary, these three major variables emanating from the human element, the machine condition and the type and surface condition of the material ground must be controlled to the maximum degree if the test results are to be accurate and conclusive. It is generally impractical for grinding wheel users, particularly in the steel mills and foundries, to conduct controlled tests in their laboratories to compare efficiencies of different grinding wheels. They must resort to on-the-job tests and cope with conditions far short of ideal for good testing, because production and shipping schedules and other important considerations frequently prevent attainment of the constant conditions required. Despite these obstacles and limitations, the following minimum requirements must be met:

1.) The same group of operators must be employed to the same extent on each of the sample lots involved in the test.

2.) The same group of machines must be used.

3.) The types of material ground in the test, as well as the dimensions of the work, must be the same or very similar.

TABLE 3

Sample	Contact Hours	Lbs. Metal Removed	Lbs. Removed Per Hour	Wheel Cost/ Lb. Removed	L & O Cost/ Lb. Removed	Total Cost/ Lb. Removed	% Higher Than Lowest Cost
			10 WHEELS				
A	7.43	668	89.91	$.095	$.083	$.178	——
B	7.71	554	71.85	.115	.104	.219	23.0%
C	8.21	618	75.27	.103	.100	.203	14.0%
D	7.19	505	70.24	.126	.107	.233	30.9%
			15 WHEELS				
A	8.08	579	71.66	$.110	$.105	$.215	1.9%
B	7.54	502	66.58	.126	.113	.239	13.3%
C	7.92	583	73.61	.109	.102	.211	——
D	7.50	490	65.33	.130	.115	.245	16.1%
			25 WHEELS				
A	7.96	590	74.12	$.108	$.101	$.209	——
B	7.60	557	73.29	.114	.102	.216	3.3%
C	7.23	560	77.46	.113	.097	.210	.48%
D	7.05	521	73.90	.122	.102	.224	7.2%
			35 WHEELS				
A	7.53	559	74.24	$.114	$.101	$.215	——
B	7.55	546	72.32	.116	.104	.220	2.3%
C	7.1	541	76.20	.117	.098	.215	——
D	6.98	518	74.21	.123	.101	.224	4.2%
			50 WHEELS				
A	7.62	571	74.93	$.111	$.100	$.211	——
B	7.75	569	73.42	.112	.102	.214	1.4%
C	7.35	554	75.37	.115	.100	.215	1.9%
D	7.40	551	74.46	.115	.101	.216	2.4%

Machine: Manual Swing Frame
Wheel: 24 x 3 x 12 Resinoid at $63.49
Work: Slabs, 300 series Stainless
Labor & Overhead: $7.50 per Contact Hour

TABLE 3. MINIMUM NUMBER of wheels required for good testing on a given operation must be found empirically. It's the number of wheels required to give reproducible test results. Note that even the order of superiority of A, B, C and D changed until size of sample reached 50 wheels. Conclusion: Samples of less than 50 are dangerous for this job.

How to Reduce Snagging Costs

4.) The standard wheel with which the test wheels are to be compared must be included in the same test.

5.) The sample lots must consist of any equal number of wheels.

These five requisites of good testing will minimize the three main variables. Those that remain must be neutralized by being averaged. It is not likely that this can be accomplished in a brief test, and here we encounter perhaps the greatest single pitfall to good testing. It's too bad, but there's a lamentable tendency toward shorter rather than longer tests. The only way to insure that the variables common to the job have come into play and that a representative cross-section of the work has been included in the test is to make certain that the test is long enough.

In table 3, the four groups consisted of an equal number of wheels *of the same specification*. It was logical to expect only small differences in their results which would be statistically insignificant. You'll notice that the expected results were obtained for each 50 wheel sample. At the 10 wheel mark, however, the results varied greatly, also at the 15 and 25 wheel marks. Further, the *order* of superiority varied

w thout pattern. At the 35 wheel mark the differences in the results were much less and at the 50 wheel mark they became insignificant. The conclusion to be reached is that on this particular operation samples of less than 50 wheels are insufficient, as the danger of obtaining deceptive results from smaller lots is prominent.

How to Evaluate Test Data

While the accumulation of reliable performance data is essential to testing of grinding wheels, of equal importance is the proper evaluation of these data. In steel mill and foundry tests the determining factor is the cost per unit of work produced. In some cases it is expressed in tons of material processed, in others in pounds of material removed from the work by grinding. This cost is usually comprised of wheel cost and labor and overhead cost per unit produced. Determining the wheel cost is no problem since the value of the wheel is fixed by its purchase price, but the basis for determining the labor and overhead cost is quite arbitrary and varies greatly from mill to mill. Some organizations have established a factual and realistic hourly labor and overhead figure which they employ in their cost formula, taking into account all departmental overhead and a portion of the general overhead, maintenance and amortization of equipment, as well as the direct labor cost. Others employ an hourly labor and overhead figure which is sometimes *less than the current direct labor cost alone*. The use of an actual hourly labor and overhead figure is important only because it places a value on the rate of cut of a grinding wheel. It may help the user determine such questions as whether he will profit from decreasing his wheel cost by increasing the wheel life, even though this gain is accomplished by a reduced rate of cut. Or perhaps an increase in rate of production will result in an advantage even though wheel life is sacrificed to some extent. Without the use of an hourly labor and overhead figure in a simple equation these determinations could not be made, nor can they be made accurately without the use of an actual labor and overhead figure. Too low a figure would falsely emphasize the wheel cost per unit ground, while too high a figure would put an abnormally high value on the rate of cut. In either case the result could be the selection of an improper specification or a wheel with a lower true efficiency for that grinding operation.

"Even an apparently small increase in stock removal can be very expensive to the steel producer. . . . In many cases the loss would more than offset the saving in labor and overhead costs."

Use of a correct labor and overhead figure also helps to dispel the misconception about the merits of a long wheel life. Wheel durability is frequently overemphasized. A better measure of wheel life isn't how long it lasted, but how many units of work it produced. Actually, the shorter the time required to produce a given number of units, the better the wheel. Amazingly, this is not a prevalent belief among grinding wheel users. When a correct labor and overhead figure is employed, the wheel is charged with that amount for each hour of its life, and this charge can be offset only by the wheel's ability to remove metal at a satisfactory rate. Thus wheel life, as such, is deemphasized.

With the steady increase in labor, maintenance and overhead costs we've had in recent years, the steel industry has found it necessary to increase the output per man-hour in their billet and slab grinding of alloy steels. It has elected to get this increase not by going to softer, faster cutting wheels, as was done during World War II, but by utilizing higher grinding pressures. There can be little argument with this approach, since it has been clearly established that higher grinding pressures, together with harder grade wheels, give more economical performance. But care must be taken that this trend toward high grinding pressures does not cause us to focus attention entirely on the rate of cut, to the exclusion of other important factors.

One of these important factors is the sacrifice in wheel life as measured in terms of units of metal removed per unit of wheel consumed. Another is the removal of a greater than necessary amount of metal to satisfactorily remove the defects from the slab or billet. In the case of stainless steel slabs, the average weight loss due to grinding varies between 2½ and 3% when ground with a manually operated swing frame machine. The rate of metal removal is usually in the vicinity of 50-60 lbs. per hour. Increasing grinding pressures by using mechanical grinders can result in a rate of removal as high as 120 lbs. per hour. The economies realized are self-evident: direct labor cost per unit of work can be reduced substantially as well as the overhead cost per man-machine hour. However, if applying higher grinding pressures causes the removal of more than the minimum amount necessary to clean the slab, thereby decreasing its yield proportionately, the commercial value of the wasted stainless steel is apt

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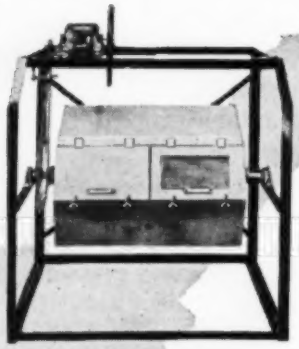

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Reduce Snagging Costs

"Actually, the shorter the time required to produce a given number of units, the better the wheel."

to be greater than the economy derived from the increased rate of production. So care must be taken to insure that grinding pressures are not increased beyond optimum efficiency, namely the point where the ratio of metal removed to wheel consumed is affected adversely and/or the weight loss by grinding is greater than necessary.

Even an apparently small increase in stock removal can be very expensive to the steel producer. For example, if a weight loss of 3½% instead of 3% occurred in grinding a slab of 18-8 stainless steel weighing 3200 lbs., the number of pounds lost in excess of the minimum would be 16. If the steel had a commercial value of $.30 per lb. at this stage, the monetary loss would be $4.80 per ton of steel processed. In many cases this loss would more than offset the saving in labor and overhead costs. Result: false economy.

Application of grinding pressure high enough to be destructive to the wheel by continual crushing of its periphery is also uneconomical. The result of this malpractice is a sharp reduction in the number of pounds of metal the wheel can remove during its life. This loss may be sufficient to offset the advantages derived from the increased rate of cut. In this instance we would have an exchange of one efficiency for another, without a genuine reduction in cost.

How to Select Vendors

Frequently, vendor participation in the available grinding wheel business is determined by the position of the vendors in terms of lowest cost per unit produced. For example, supplier A, having the lowest cost, is awarded 40% of the business, while supplier B in second position is given 30%, and supplier C 20%. Lowest ranking supplier D, having the highest cost per unit produced, may be allotted a token amount of 10%. This method of allocation is usually highly beneficial to the user. It creates keen technological competition among the suppliers in wheel development and application engineering. As supplier A strives to maintain his advantageous position, the others try to improve their products, thus their positions, in order to win a larger share of the available business. The wheel user gains with each improvement.

Care must be taken, however, to insure that the differences in the costs of the various suppliers are real and significant. For example, let's assume that a well conducted test of samples from four suppliers rendered the following costs:

Supplier	*Cost per Lb. Metal Removed*
A	$ .258
B	.261
C	.269
D	.295

It would be improper to consider supplier C as third ranking and allocate 20% of the business to him, because his cost is only 4.3% higher than that of supplier A. This minor difference is less than the margin of error or normal variation to be expected in even the best controlled on-the-job tests, and a repetition of the same test would likely result in a change in the order of superiority of the first three suppliers. The difference in the costs of suppliers A and D is 14.3%, which would be considered a significant difference in a well controlled test.

Summing up, we have noted that:

1.) Grinding wheel tests are an important tool to management in the control of grinding costs and in the economical selection of vendors.
2.) To render dependable data, grinding wheel tests must be planned so as to exclude the job variables.
3.) The test results must be properly evaluated.
4.) The differences in the end costs must be carefully judged as to their significance. • • •

Surface Grinding

HORIZONTAL SPINDLE—RECIPROCATING TABLE

IN THIS SERIES—

1. ADVANTAGES—APPLICATIONS—ECONOMICS
2. FUNDAMENTALS AND METHODS
3. MACHINES, ATTACHMENTS, SPECIAL DEVICES
4. WHEEL SELECTION AND WHEEL FORMING
5. CAUSES OF FAULTY SURFACE GRINDING AND CURES

Part 2: Fundamentals and Methods

Prepared by the editorial staff of GRINDING and FINISHING and Edmund Mottershead of Mottershead Associates.

● The fundamentals of surface grinding, like those of other forms of grinding, are pretty generally known. But since surface grinding is becoming each year more and more a production process, as opposed to the long accepted small-lot finishing process, a review of the fundamentals as they apply to production operations is well worth while.

In using the surface grinder with horizontal spindle and reciprocating table, grinding on the periphery of the wheel—or on the face of the wheel or a formed surface—all kinds of plane surfaces can be ground accurately and speedily. The scratch pattern is parallel to the traverse motion of the work table.

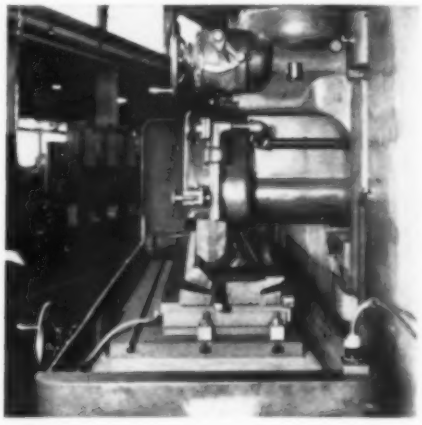
Various manufacturers have developed a number of conveniences in operation which include variable speeds of traverse or return of the work table, step and repeat motions of the work table, automatic down feed for the wheel, automatic crossfeed for the wheel, and similar movements which can be achieved either by hand or by pre-set automatic controls. Coolants may be fed to the point of contact between grinding wheel and work either through the conventional pipe or tube arrangement or through the grinding wheel itself, utilizing the natural porosity of the wheel to deliver a mist of coolant at the point of contact.

Fundamental to the design of these machines, of course, is extreme rigidity and parallelism of all the parts. Spindle design involves the use of suitably heavy bearings to maintain wheel accuracy, a constant distance between spindle and table, and such other conditions as are required by precision work often obtaining tolerances measured in the hundred-thousandths.

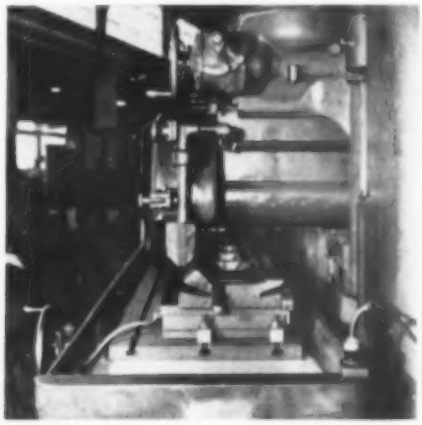
The heart of any precision grinding machine is the grinding wheel spindle and its bearing. Any wear in the bearing that permits the spindle to vibrate will render the machine useless for precision work. When the bearing condition is not stable, vibration may be set up which will be transmitted to the wheel and thence to the work. The result is a constant change in pressure between wheel and work. Similarly, wheel balance is essential to good surface grinding. Properly performed, the wheel is first mounted on the grinding machine and then formed or trued. The entire wheel unit is then removed and balanced. After this, it is replaced on the machine and is ready for precision grinding. As the wheel runs, it must then be trued from time to time to maintain the accuracy of its relationship with the work.

For some types of work, the

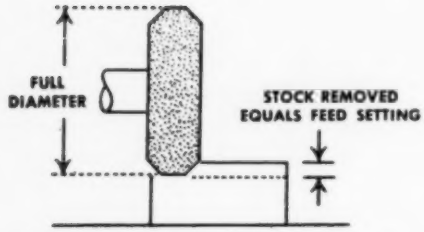
WAY GRINDING performed with preformed wheel is shown in these three pictures with wheel performing three of the necessary operations. Flat periphery of wheel handles top surfaces with cross feed movement of wheel.



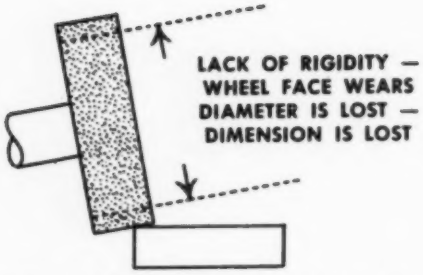
SECOND OPERATION in way grinding job has one bevel of wheel grinding surface of one bevel of way. Magnetic chuck holds work securely. Coolant nozzle has been removed to allow clear view of wheel and work.



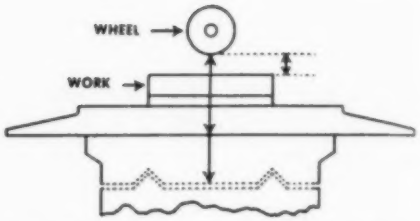
THIRD OPERATION in way grinding job is performed with inside bevel of wheel against outside bevel of work. Grinding with preformed wheel on jobs of this sort may be done either in one pass with preset down feed or in repeated passes, bringing wheel down a few tenths at a time.



DRAWINGS ILLUSTRATE the necessity for extreme rigidity and precise alignment of wheel, wheel spindle, and work table. The leading edge of the wheel takes the brunt of the cutting action. These edges wear, but the wheel face and diameter must remain intact in order to assure stock removal in accordance with feed setting in one-pass infeed.



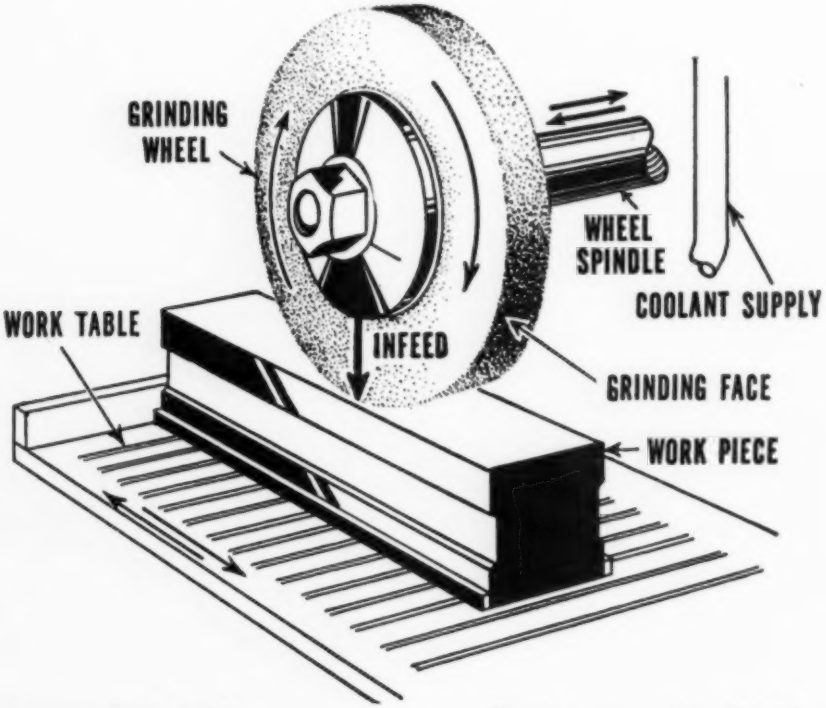
IF SPINDLE OR COLUMN "give" under cutting pressure, the wheel will "climb" the work, the wheel face will wear, probably unevenly, and an insufficient amount of stock will be removed from the work. Rapid cross feeds during table reversal are important in control of wheel diameter. Sluggish cross-feed may cause the wheel to contact the work at right angles with disastrous break-down of the wheel.



MAINTAINING table to wheel distance under load is similarly derived from adequate rigidity. If "give" or deflection of the spindle, table, or saddle occurs under working load, the grinding wheel cannot remove the proper amount of stock indicated by the feed setting.

workpiece is clamped to the table, but modern practice on most jobs involves the use of magnetic chucks. Grinding wheels exert little if any pressure sideways on the work, and there is rarely any difficulty in getting the magnetic chuck to hold firmly, provided there is sufficient area of the work in contact with the chuck. Only magnetic metals can be held, of course, but a little ingenuity will take care of non-magnetics also.

Fundamental to good surface grinding is the proper care of these chucks. Basically, this means the chucks must be kept clean, smooth, and accurate as to surface and its relationship with the grinding wheel. When chucks are removed from the grinding machine they should be greased and protected from nicks and bumps which might mar the surface. During operating, the chuck should be wiped off from time to time with a rag, a bit of old leather, or the flat of the hand. A clean chuck is seldom in trouble, and it assures accurate work from proper seating of the workpiece.



Horizontal Spindle — Reciprocating Table

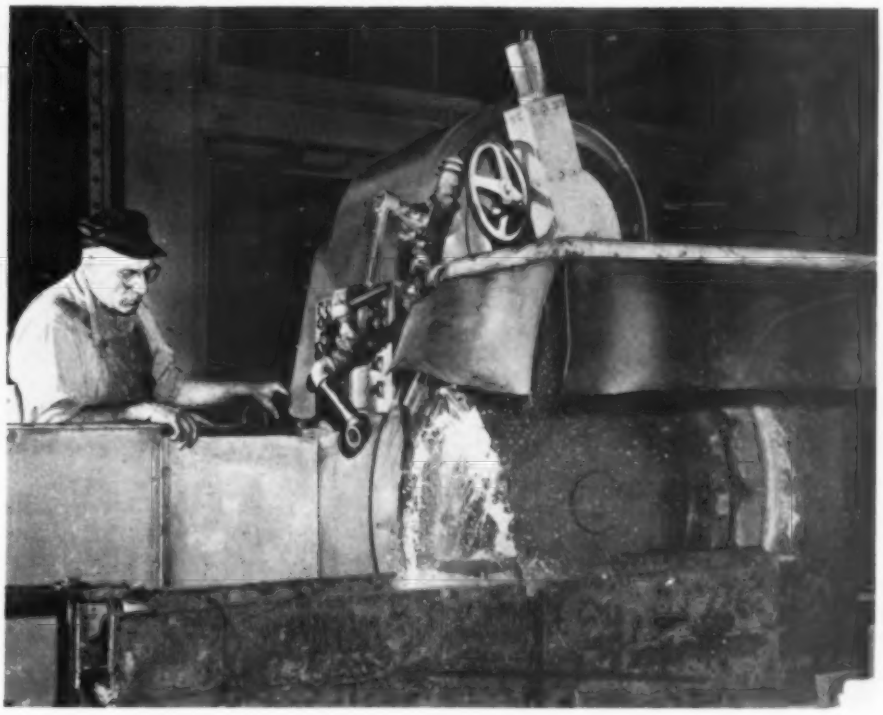
BASIC SCHEMATIC ARRANGEMENT of the components involved in surface grinding with horizontal spindle reciprocating table machine. The work table traverses back and forth under the wheel. Wheel rotates clockwise, so that work feeds from left to right into the turning wheel. Wheel is mounted on a spindle which provides cross feed at right angles to the traverse of the table. Spindle is mounted in a vertical column (not shown) so that the entire wheel assembly may be moved up and down to provide infeed. The coolant supply may be fed at the work by an exterior tube which sprays coolant at the point where the wheel contacts the work; or, it may be fed through the spindle and directly through the wheel, using the natural porosity of the wheel to transport the coolant.

Grinding Conditions

The work speed on reciprocating tables is generally expressed as the rate of traverse in terms of feet or inches per minute. The general range is from 1 to 100 surface feet per minute, with two common classes of machines—those with traverse speeds of over or under 35 s.f.p.m. Machines in the higher range are generally considered high production machines. When producing high finish, the work or table speed should be somewhat lower than the average.

Where form grinding is performed by form faced wheel without crossfeed of the wheel, and where the holding of the form on the face of the wheel is of paramount importance, lower than average work or table speeds are usually necessary.

Crossfeed speeds of the grinding wheel should be in proportion to the width of the wheel and the finish desired. Crossfeed should not exceed, even for rough grinding, one half of the wheel face per revolution. The lower the crossfeed for any given width of wheel face, the greater the depth of cut that can be



LARGE SURFACE GRINDER, using a side grinding wheel—face grinding operation—to grind large cast steel brake bases. Formerly machined on a planer, these pieces are now finished to accurate limits three to four times faster than previously. All cuts are finishing cuts, whereas formerly first operations were roughing cuts, followed by finishing cuts.

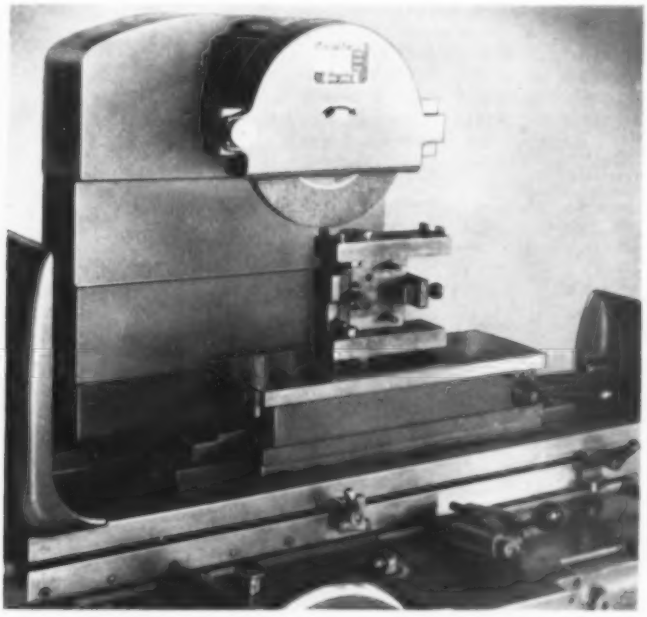
taken. When producing extremely high finishes, lower than average crossfeed speeds should be used.

Infeed, of depth of cut, is controlled by the amount of metal to be removed, the finish desired, and the power and rigidity of the grinding machine. Other controlling factors are the desired accuracy of work and the amount and nature of coolants used.

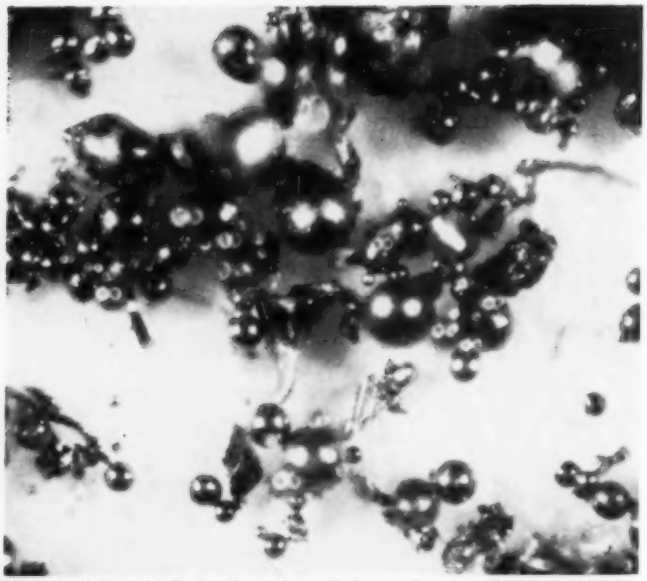
Depth of cut determines to a very great extent the amount of pressure built up between wheel and work during the grinding operation. High working pressures may create heat with attendant distortion of work, or burring of the surface. This stock requires reduced infeeds and lighter cuts. Dry grinding operations necessitate lighter cuts than if the operation were performed with coolant.

Surface grinding operations may be performed dry. However, modern practice tends towards the use of either water or oil coolants. The principal purpose of the coolant is to dissipate the heat generated during the grinding operation, although there is considerable advantage to the lubricating action of some coolants. Essentially, the coolants aid the grinding wheel to reproduce the desired dimensions of the work more accurately, influence

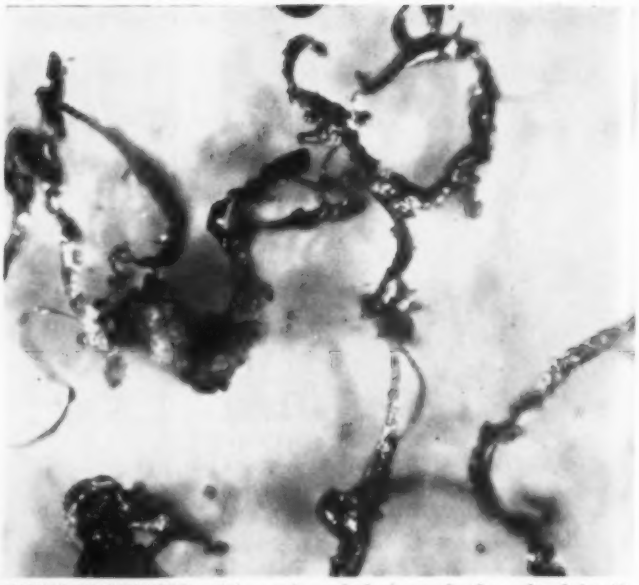
FORM GRINDING with pre-shaped wheel makes an easy task of putting precise radius on this piece. A radius and angle dressing device to true the wheel is attached to the machine for periodic retruing of the wheel to maintain the necessary profile.



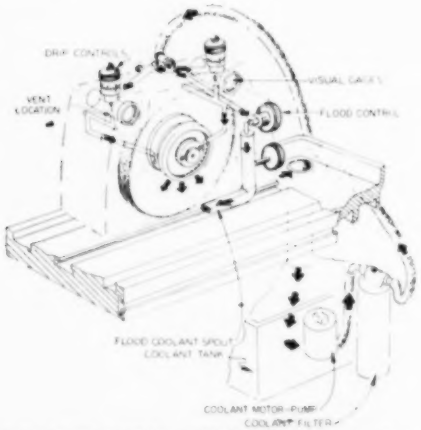
SURFACE GRINDING of pins in die held on magnetic chuck makes it an easy task to grind all four pins to the same dimension. High degree of accuracy and excellent finish from this type of grinding make it particularly useful in grinding tools, jigs, and dies.



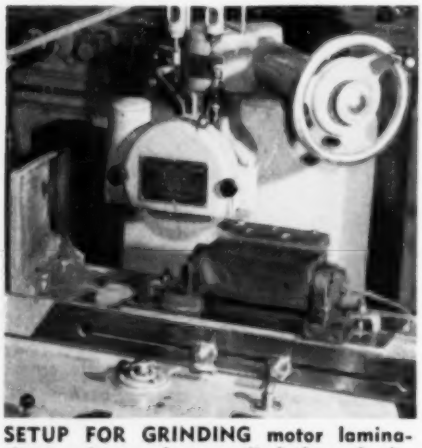
GRINDING PARTICLES obtained from dry grinding—with no coolant—magnified 300 times. Note the profusion of round globules, the absence of long chips, and the presence of many small chips. This indicates excessive heating of the work.



CHIPS PRODUCED with coolant fed through the wheel itself, emerging as a mist at the point of contact. Note virtual absence of globules and presence of relatively large, long chips indicative of efficient cutting action of grinding wheel.



DOALL'S "COOL GRINDING" embodies any or all of three elements: (1) Coolant fed through the natural porosity of any standard wheel; (2) The same coolant fed through the wheel under pressure to increase flow; and (3) Coolant flooded in the conventional manner behind the wheel. Depending on the job, any one or a combination of these methods may be used for efficient cutting action of the grinding wheel without excessive heating of the work.



SETUP FOR GRINDING motor laminations, using coolant applied through the wheel.

the form of chip obtained, provide anti-rust characteristics, and tend to prevent the loading and glazing of the wheel.

Wheel speeds are also variable over a wide range. As a general guide, machines with tables having a traverse rate on the order of 35 sfpm should have wheels operating between 4500 to 5500 sfpm. With higher reciprocating table speeds, wheel speeds may range up to 6500 sfpm and give satisfactory work.

Surface Grinder Maintenance

Grinding machines, no matter how used in high production, are still precision machines from which the best results may be obtained only when the machines are kept clean, well oiled, and maintained in proper adjustment. Major considerations in grinding maintenance include attention to wheel spindles and bearings, drives, motors, lubrication, grinding compound, cleaning, and the hydraulic system.

The grinding wheel spindle and its bearings are the most important part of the grinding machine. A good rule to follow in maintenance of these parts of the grinder is never to touch the spindle or its bearings if it is functioning in a satisfactory manner. Much of the trouble with spindles is caused by insufficient thrust adjustment which permits the spindle to take on a slight reciprocating motion, causing the wheel to impart a light spiral or wave mark to the surface of the work. As modern spindles run efficiently at temperatures of 140° F., it is considered good practice to operate the machine for a warm-up period. Running hot indicates too little clearance or lack of lubrication, while too cool operation indicates too much clearance, in which case both finish and accuracy will suffer. Correct clearance varies with the size of the spindle and the type of wheel employed. Consequently, the manufacturer's recommendations with respect to the amount of clearance should be observed closely.

Multiple V-belt drives respond to increased load in action by digging deeper into the grooves of the sheaves. It is important to keep all sheaves aligned and to use a matched set of belts. These belts stretch after some use, and it is usually necessary to readjust for length, as insufficient tension will prevent full power delivery. In replacing belts it is good practice to replace the entire set in order to be sure they are all under the same tension and each belt is taking its share of the load. It is also unwise to pry V-belts from the sheaves by using a pipe or a bar, since there is a possibility of rupturing individual belts. To prevent exposure of the

belts to the action of water, oil, or grease, it is essential to keep the guard in place—which is a simple safety precaution in any case. Never apply belt dressing to V-belts, as this will cause the drive to slip and reduce power output.

Lubrication: There is no substitute for sufficient good lubricating oil of a type specified by the machine manufacturer. Oil cups should be examined regularly and kept at the proper level. Wheel spindles operate with a few ten-thousandths of clearance at high speed and under heavy loads. Lacking lubrication, these spindles will stick very quickly. Hence the lubricating oil reservoir should be checked at regular intervals and kept at the right level. Similarly, oil regulating valves should be inspected from time to time, especially when the machine is started. It is particularly important in machines having automatic or forced lubrication to check the work carriage guides in order to determine whether they are being lubricated. Most oil filters on grinding machinery require a turn at intervals indicated on the filter. If they are not so turned, the filtering element ceases to function, dirt and grit are not filtered out of the oil.

Clean the coolant reservoir frequently so that the grinding compound does not become loaded with swarf and wheel particles. Failure to observe this precaution will not only result in scratched surfaces on the work, but may also cause overheating, as with a coolant tank full of sludge, only a small amount of coolant is circulating and it never gets a chance to dissipate the heat.

Hydraulic systems are set at the factory and will function properly for long periods of time if not disturbed. Most of the difficulties with hydraulic systems can be avoided if the proper oil is used and the oil filters replaced or cleaned periodically. It is good practice to examine the oil in the systems at least once a month, and if it is milky or cloudy or shows waxy deposits, it should be removed and replaced.

Grinding Stress and Coolants

It has been discovered that right at the point of grinding, where the wheel and work are in contact, temperatures well in excess of 2700° F., the melting point of steel, are generated, and that under the influence of coolant or lack of coolant, surfaces might tend to scorch, warp, or crack.

Grinding not only generates heat. It also develops terrific pressures over small areas. In grinding a cut .002 deep across annealed strip steel, surface stresses on the order of 270,000 psi are generated.

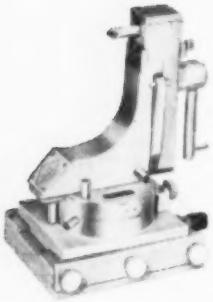
Other factors also influence the amount of heat and stress. According to John Harrington, chief engineer of the grinder division, DoAll Company, the condition of the grinding wheel, the bed, and the method of dressing the wheel all affect stress and heat effects. Tests made with 52100 steel with a hardness of 65 Rockwell, and a depth of cut of .001, ½ inch wide, table speed of 4 fpm showed that conventional diamond dressers produced wheels which averaged only about 5 cuts before burning the work.

There must be space in the face of the wheel for chip load and chip clearance. A grinding wheel is really a multiplicity of single point cutting tools held in a bond, and the space between these points has to be ample to absorb chips produced in grinding. A loaded wheel acts more as a burnishing wheel and can generate enough heat to melt the material rather than cut it off in the form of chips.

This can be seen by examining grinding chips under the microscope. The ideal chip shape from any cutting operation is generally considered to be a long, thin strip. Chips produced by a badly dressed wheel, or by one which is running too hot from some cause, will tend to be a number of globules of melted metal. Chips produced by a free cutting wheel properly dressed, using sufficient coolant of

AT SIMONDS SAW AND STEEL CO., Fitchburg, Mass., this travelling table face grinder grinds accurate bevels on machine knives held on a magnetic knife bar. Open design of the machine makes for easy loading and unloading of the knives. Similar machines are grinding shear blades, pump castings, motor frames, large dies, and other parts which were formerly milled or machined on a planer. Experience indicates that in many cases grinding produces a more accurate job, faster.

J&S DOWN-HOLDING DEVICES and WHEEL DRESSERS LEAD THE FIELD



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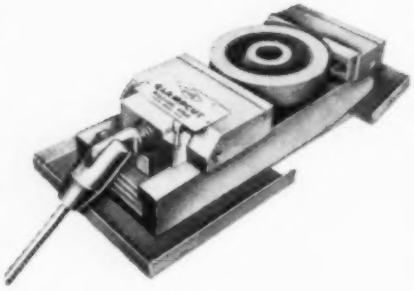

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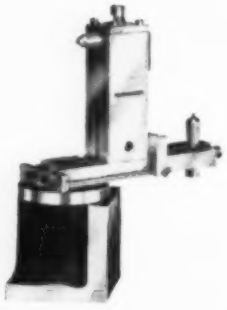

J & S Form-Master—Sturdy wheel dresser for shops with less frequent wheel dresser requirements. High quality, 100% dust-proof, it is capable of dressing any radii up to 12″ convex, up to 15″ concave.

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the right type, tend to take the form of the well-known chip removed by other metal cutting operations.

The known principles of heat exchange have indicated the desirability of applying coolant in the form of a spray or mist to achieve a larger, more absorbent area of coolant at the point of contact. The rotation of a vitrified grinding wheel creates a centrifugal air pump action whereby the air is drawn in at the sides of the wheel, forced through the wheel's porous body, and out its surface with pressures on the order of 40 psi. Various through-the-wheel methods have been developed to apply water or oil coolants either at the sides or hub of the wheel, force them through the wheel itself and out on the surface in the form of the desired mist.

Further study of coolants has brought about consideration of oil as a coolant, rather than the familiar water-plus-grinding compound. Essentially, it boils down to this: Oil is a better lubricant, but it will not dissipate heat as readily as water soluble coolants. Thus, on jobs where lubrication is more important to obtain free cutting than is the reduction of heat to preserve the surface of the work, oil does the better job. Where heat reduction is paramount, soluble coolant is the preferred choice.

The lubricating action of oil on a grinding wheel is analagous to its action in a milling cutter. Proper lubrication of the teeth of a milling cutter is recognized as essential to reduce the friction between the tooth and the chip on one side, and between the tooth and the work on the other. This reduces heat at the source and reduced the tendency of the fine chip particles to adhere to the cutting tooth and gum up the works. Similar events occur when oil is used with a grinding wheel, the main difference being the microscopic size of the chip particles involved. If anything, lubrication of the grinding wheel is perhaps even more desirable on the basis that there is generally relatively less chip clearance and more inherent tendency for the chips to fill or glaze the wheel surface. •

(Part 3 will appear in May.)

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Capacity:	8" wide, 24" long, 21" high from table to center of spindle. Standard wheel 12" x 3" x ¾" included.
Table Speed:	Infinitely variable from 0 to 90 F. P. M.
Cross Feed:	Infinitely variable from .001 to .250.
Floor Space:	93" x 51½" x 71¾" high.
Weight:	4,000 lbs., Net.

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Central Coolant Systems

improved race grinding at Fafnir

by **C. A. Wallace,** Manager
Industrial Filtration Division
U. S. Hoffman Machinery Corporation

● The experience of Fafnir Bearing Company, leading independent producer of ball bearings, points up the advantages of central coolant purification systems for high-volume precision grinding operations. Among the distinct advantages: longer life and better cutting action of grinding wheels, improved quality and uniformity of parts, reduced machine cleanup time, and elimination of the bad odors caused by bacteria.

One of the most critical operations in bearing manufacture is finish grinding of the races. For example, requirements are so rigid that during the grinding process, excessive temperature of the work due to friction or even due to warmth in the liquid coolant can cause enough distortion in the work to create dimensional variations and subsequent rejects. This is only one of the quality factors involved in the change-over from individual coolant filters on centerless grinders to the present central system serving all grinders.

At the main plant is a special building housing the filtration equipment, which was erected in 1946 in an inner court surrounded by a 5-story production building. This building is shown in Figure 1.

In this special house are two No. 56 Hoffman clarifiers and one Dual 66 in operation, while another No. 56 machine, a deep-tank model, has been moved into the building and was reinstalled as standby for plant expansion. In the foreground of Figure 2, the top of one of the No. 56 clarifiers is shown. This machine handles 250 gallons per minute of Lusol, a synthetic made by F. E. Anderson Oil Company. Chief characteristics of the compound are that it prevents loading of the small, high-speed grinding wheels used to finish the internal diameter of the inner races, as well as providing constant temperature to the work. Running this machine at full capacity gives thorough clarifying action, but it is recognized that overloading any of these clarifiers results in incomplete cleaning of the compound.

At the right of Figure 2 is the other No. 56 flotation unit operating on standard-grade soluble oil from inner-race grinders where a finer surface is required, using a finer wheel and taking advantage of the slight glazing effect of the combination of this wheel with the cleaned coolant oil. Grinders of the types served by this unit are shown in Figures 5 and 6. This clarifier is also used at capacity.

In the background of Figure 2 is the Dual No. 66 Flotation Unit installed in 1951 and processing 700 gallons per minute of a 3% sodium nitrate solution plus a minimum of soda ash and soluble oils adding 0.1% to the total volume to cause the proper amount of foaming for flotation purposes. The capacity of this machine is 800 gallons per minute. Originally, a soda ash solution alone was tried but it foamed up so vigorously that the tank overflowed in operation. The machines served by this clarifier are centerless grinders of outer races.

Figure 3, taken at the end of the Dual No. 66, shows the residue from one 8-hour shift. Each machine fills one of these dump scuttles, each containing steel grinding sludge and a small proportion of abrasive, in one shift, the amount varying with the nature of the job. The operator keeps the Hoffman machinery in such excellent order that the equipment house and its newer branch, look like a Navy vessel on Visitors' Day.

A cinder-block shed just completed houses another Dual No. 66, Figure 4, handling the same job as the one in the equipment house, but for other departments closer to this location. Demand is 600 gallons per minute at 75% of capacity. Although this clarifier was installed in 1949, it was covered by an open shed without heat. This did not seem to affect either performance or maintenance.

Working up from the filtration equipment to the machines it serves, Figure 5 shows a double line of grinders and the coolant distribution system in this part of this department. This scene is duplicated in perhaps a dozen places in the plant, since produc-

1. SPECIAL BUILDING in interior court at Fafnir plant houses central coolant clarifiers. Fafnir credits systems with improvement in critical finish grinding operations on bearing races.

tion lines amounting to complete factories are set up to turn out individual sizes and types of bearings, without funneling their output into a common grinding department. Supply line of coolant is the 2" pipe above the trough in the center of this picture, while the used compound is returned from the discharge pipe of each machine to the trough below. The trough is needed to prevent clogging by sludge and save the grief and waste of time of cleaning out a return pipe. The troughs in turn empty into 10" downlegs carrying the dirty fluid from upper floors to the clarifiers. Experience at this plant has been that the 10" pipes have had to be cleaned out once a year, though present production rates and consequent recent speeding-up of the flow of coolants have kept the vertical pipe walls relatively free of sediment. The annual cleanout of pipes and of the tanks of the clarifiers requires 8 hours work by 6 men. The only other labor required by the Hoffman system is one permanent attendant.

Contrast this with the former system of filtering coolant in individual tanks on each machine. The fact that filtering was never quite effective meant that splashing of coolant left a dirty residue on a machine, requiring 1 man-hour per day per machine for cleaning, whereas now the clean coolant can be wiped off by the operator in less than five minutes. Other benefits found at the grinder are the elimination of bacteria and consequent odor from the machines, caused by the settling

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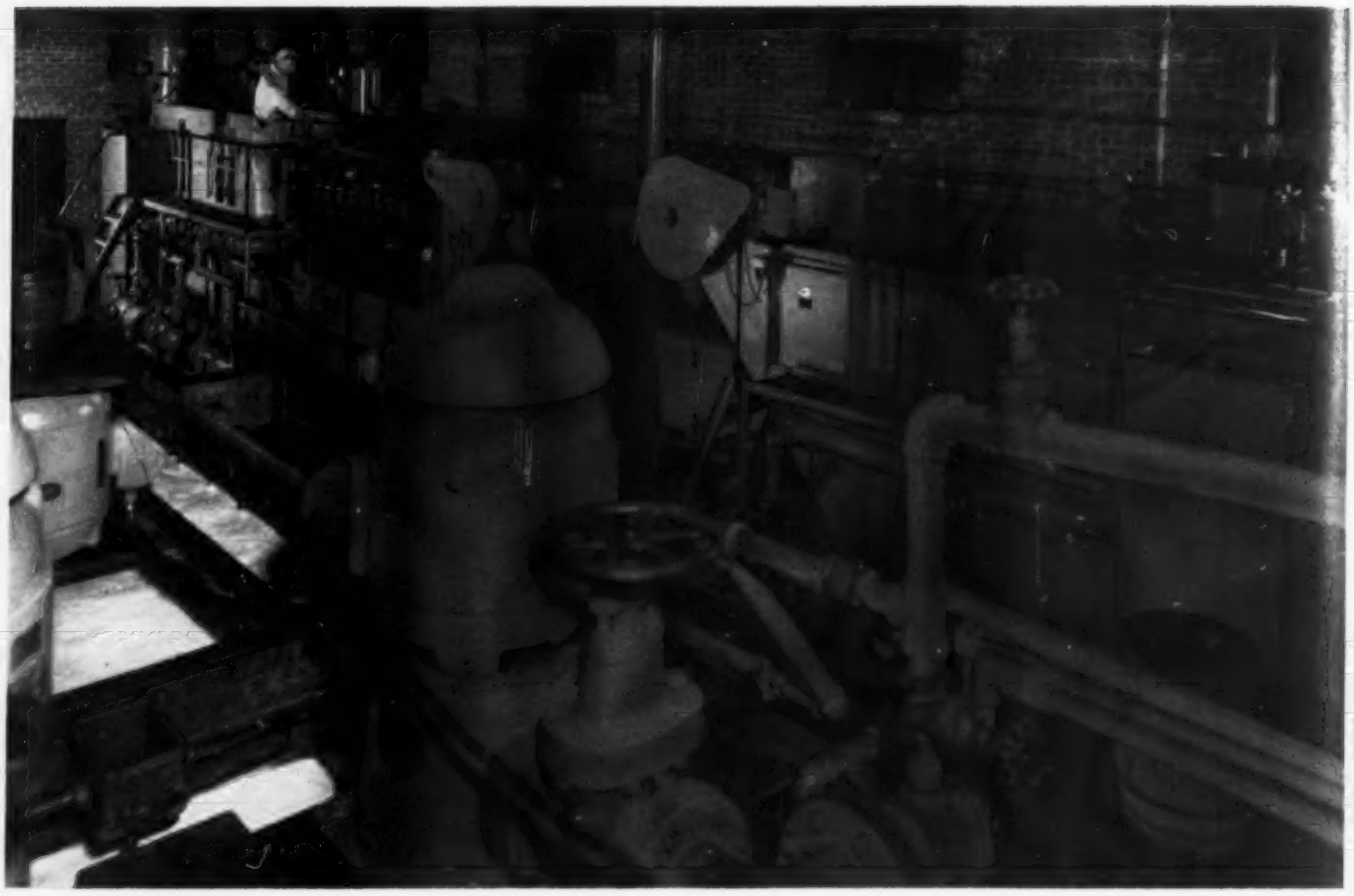
On precision grinding of ball bearing races, Fafnir's central coolant system has:

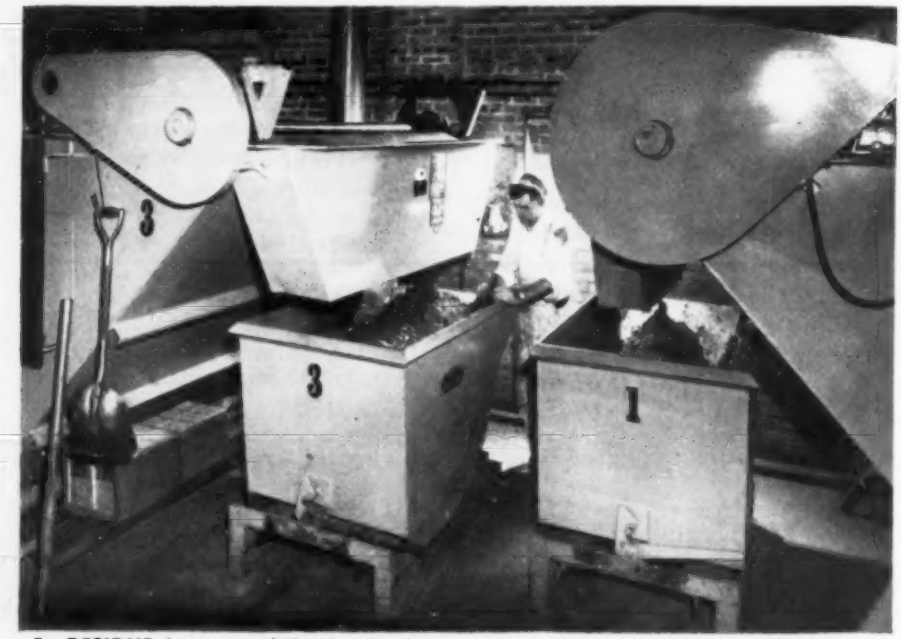
- *Improved life and cutting action of wheels*
- *Improved quality, uniformity of parts*
- *Reduced machine cleanup time*
- *Eliminated bacteria and resulting odor*



2. NO. 56 HOFFMAN clarifier, left foreground, handles 250 gallons per minute of synthetic coolant from internal grinders which finish inner race ID. No. 66 unit, left background, processes 700 gallons per minute of coolant from outer race centerless line.

of the coolant in the filter tank without the agitation and aeration effect of the Hoffman clarifiers. Where the annual "housekeeping" of a grinder and its coolant tank formerly called for emptying the tank to waste, present practice is to add coolant to the clarifiers as needed, at a saving of at least $10 per year per machine.

With filtered solutions, wheels are cleaner, longer lasting, do not scratch the work, give more uniform finish because of constant condition of the coolant, and do not glaze over. Wheel life is lengthened by a sharp reduction of the need for wheel dressing and consequent loss of wheel diameter without corresponding production. The necessity for machine maintenance is reduced and machine life lengthened by keeping abrasive sludge off moving parts. As mentioned, the 1-hour per day formerly spent in attempting to keep a machine clean has been reduced to a few minutes for a thorough wipe-down. While product rejects have been reduced by better wheel condition and by constant temperature of the coolant, these as well as the other values mentioned have been hard to evaluate exactly in terms of money saved. However, it was estimated that the entire Hoffman system paid for itself within one year.



3. RESIDUE from one shift of centerless outer race line, served by No. 66 clarifier.

Maintenance of the clarifiers themselves have been termed "entirely satisfactory." The extremely abrasive material requires annual renewal of bearings in agitators, and of sludge removal sprockets, chains and conveyor flights, but this is not considered excessive.

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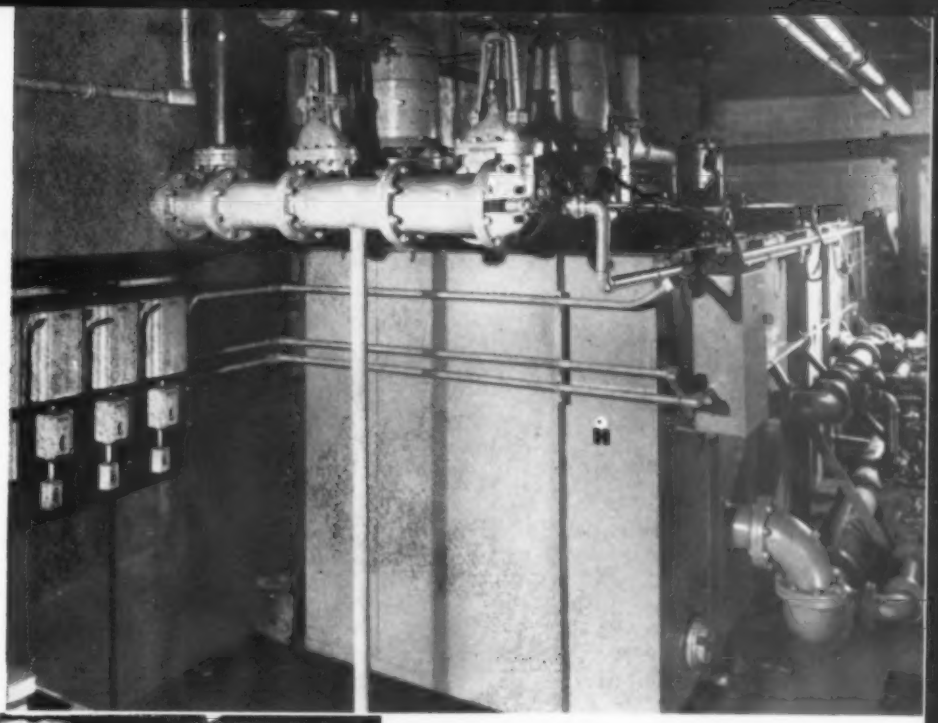
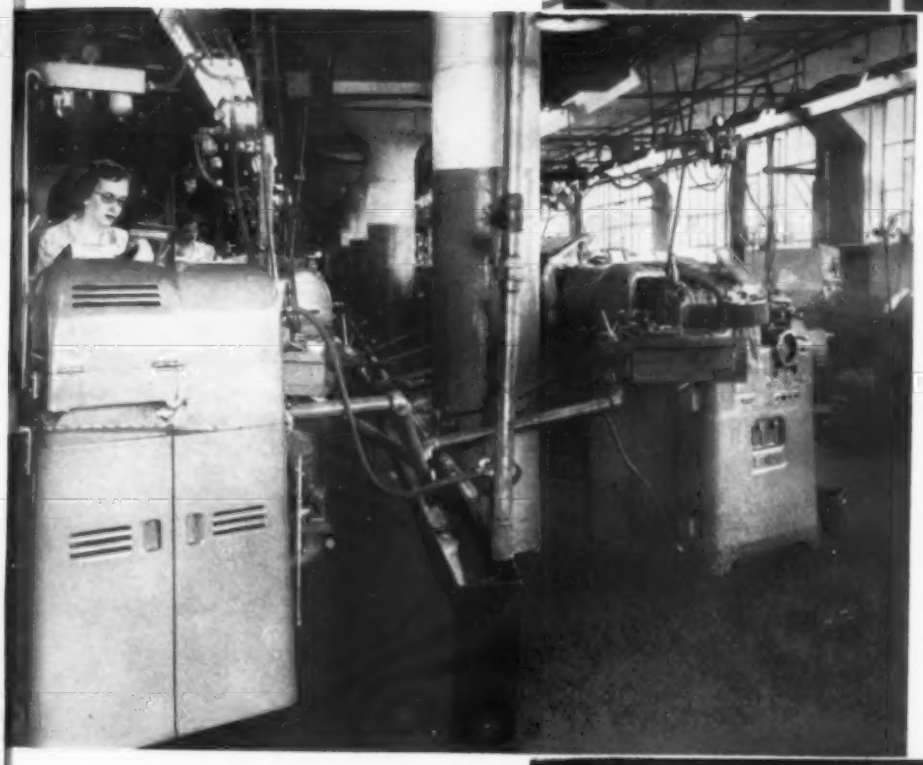
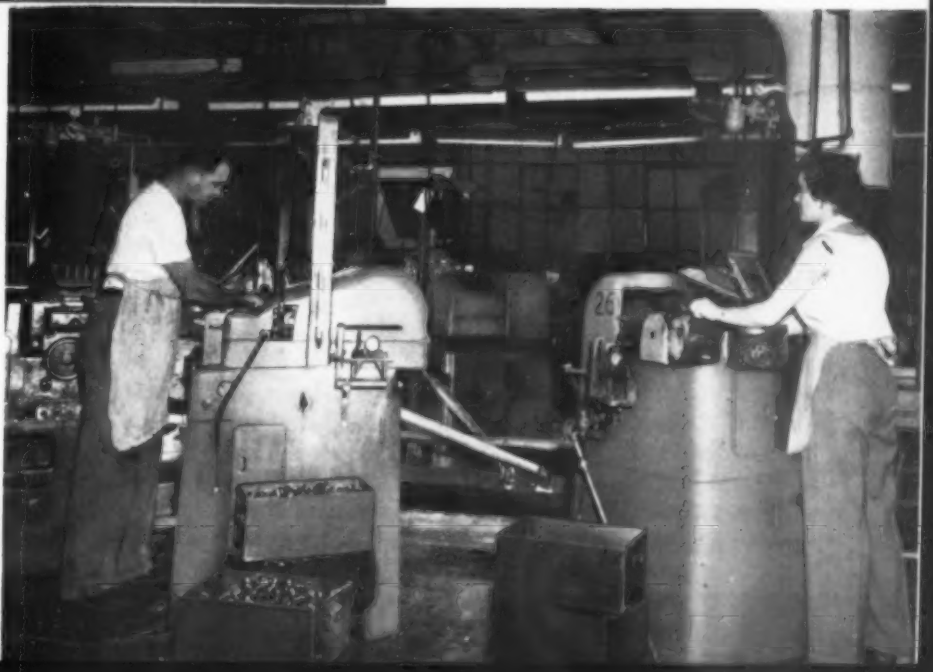
4. **DEMAND ON THIS** No. 66 clarifying unit is 600 gallons per minute, or about 75% of capacity.

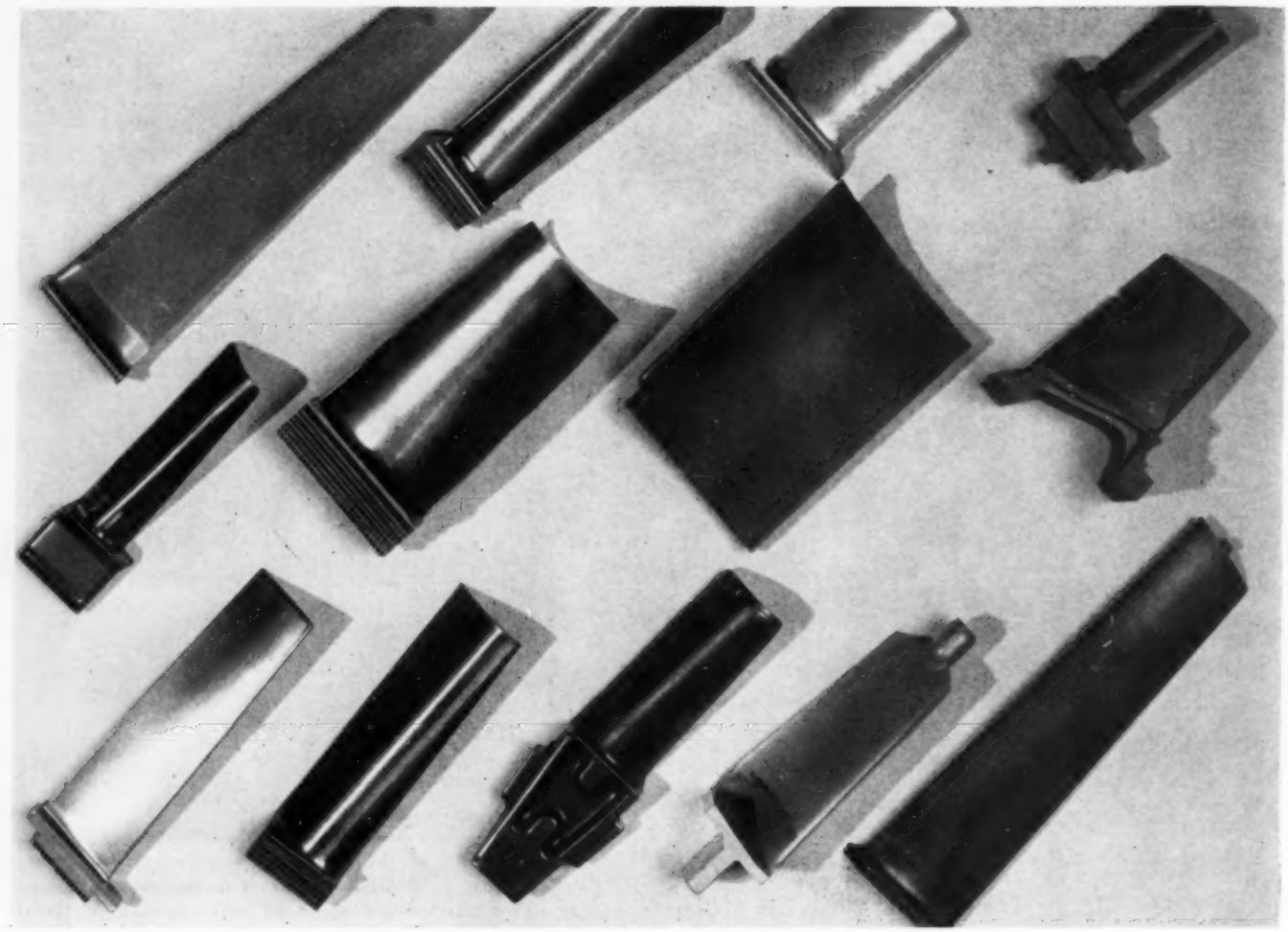




5. **LINE OF MACHINES** served by central units at Fafnir. Supply of clean coolant is the 2-inch pipe above trough, center. Used compound is discharged to trough for return to clarifiers through 10-inch downlegs.

6. **LANDIS NO. 1 RACEWAY** grinders grind outer raceways of small bearings in the Fafnir plant. Coolant supply pipe and return trough are visible beyond machines. Layout of lines was not complicated by use of central systems.





ONE AMERICAN manufacturer is producing 2,500,000 jet blades monthly. These parts are made of alloys difficult to machine, yet they must be made with extreme precision because they operate at extremes of speed and heat.

How belts are used in

Jet Blade Finishing

by **J. Karl McLaughlin**
Product Engineer
Behr-Manning Company

● The jet engine industry has turned universally to the coated abrasive belt as the economical finishing method for the vast number of blades and buckets which must be processed. This article deals with the specialized techniques which have been developed to handle the production finishing of jet blades and stator blades (used in the air compressor section of a turbo engine), jet buckets (in the hot end of the engine), and nozzle diaphragms (the stationary parts in the hot end).

Most of these are made by one of three processes:

1. Precision forging and coin pressing to a tolerance of ± 0.003 in. is used to produce the greatest volume today. Forgings, as well as the surfaces of the forging dies, must be kept clean. Some manufacturers clean the blade surface by grinding, etching, etc., as well as doing a rough contour machining job in the fillet and platform areas before final coin pressing.
2. Rough forging followed by overall machining of the blade area. This method produces a very accurate blade shape. However, certain alloys harden rapidly, increasing tool cost. Also, machine tool marks must be removed after machining.
3. Precision casting by the lost wax or frozen mercury processes. Production line methods are used by several manufacturers. Precision casting is widely used for stationary blades and nozzle diaphragms. Casting permits the use of hollow sections, which is vital in aircraft usage.

A fourth method—machining of the designed blade shape from bar stock—is usually restricted to low-production runs or experimental work where the blade shape may be changed frequently. The blade profile is formed in multi-spindle machines such as the Cincinnati Hydro-Tel and similar generating machines. Jet buckets are made by precision forging or rough forging;

MUCH WORK IS DONE with a standard lathe with backstand. This is a large-diameter, medium density contact wheel suitable for convex shapes. Smaller contact wheels can be used for concave work, such as that at right. All work is done free-hand. Machine at right is a Bader floor model, with rounded edges on the contact wheel, being used to polish bucket fillet.

with the latter, the part is machined all over. This method permits acid etching, required on certain metals mainly to disclose grain growth, should it exist.

Visiting the many production facilities of the nation discloses little unanimity of thought about the best method of producing jet blades and buckets. Hardly any two manufacturers are using the same methods—even in different plants of the same company. Engineers are still seeking better methods, and several are being worked on, experimentally, which may prove promising.

For example, considerable work is being done on formed blades made up from flat sheet stock and folded along one edge. The formed blade is fastened to a short base section which permits attachment for the blade and the attaching foot. Some stator parts are extruded in long sections, with the foot formed by upsetting.

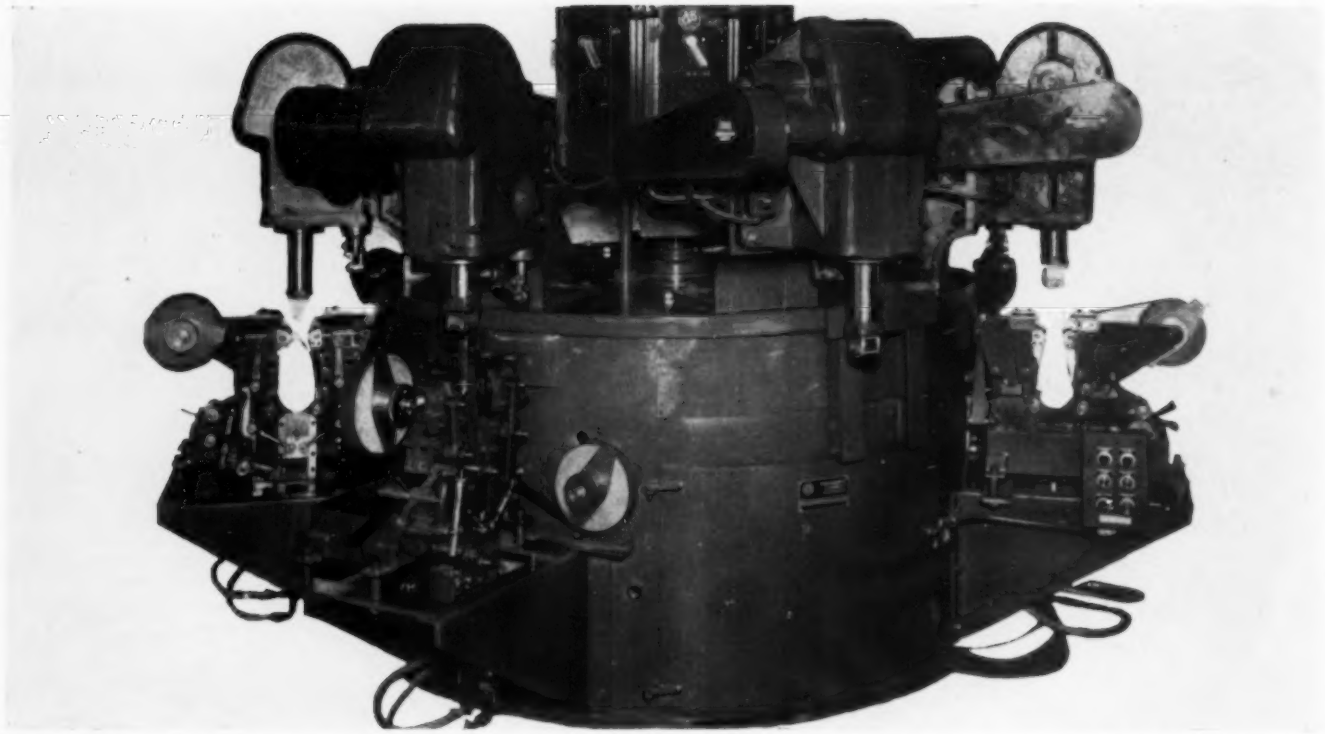
The metal used in jet compressor blades is high-chrome stainless. Alloys used in buckets contain mostly chromium, nickel and cobalt, and are considerably harder to machine. It is common practice today to broach the attaching feet on jet blades, while the "Christmas tree" on the buckets is ground. Manufacturers constantly face the possibility of the development of new alloys which may resist high temperatures and, at the same time, work-harden rapidly.

New machines developed since World War II for manufacture of jet blades use abrasives, mainly in the form of coated abrasive belts. Following is a summary of the more common coated abrasive machines developed to meet the industry's needs. For simplicity, they are listed by the following functions: correction of blade or bucket areas; fillet grinding and polishing; leading and trailing edge machines; and longitudinal polishing machines.

Correction of Blade or Bucket Areas

Regardless of the method of manufacture, there is considerable cleanup and spotting work to be done on all jet blades and buckets. Common defects such as die marks, wrinkles, casting defects, inclusions, blow holes, etc. must be removed. Blades which are precision formed do not always come within their tolerances, so that one or both faces must be corrected. Blades made from solid bar stock or rough forgings must have the proper shape ground into the metal.

Generally, much work is performed free-hand on 80-grit aluminum oxide cloth belts, bonded with resin on resin and operating over small-diameter contact wheels, on the following jobs: spotting between forging heats to remove defects; removal of machining marks after Hydro-Tel milling; removal



ENTIRELY AUTOMATIC in operation, this Acme Manufacturing model imposes the edge radius on the blade, producing between 250 and 800 pieces per hour with unskilled help. The blade is carried in a rotating fixture past the abrasive belt.

Jet Blade Finishing

continued

of casting skin; spotting to remove defects after forging; blending in the fillet and platform; and producing the proper radius and chordal width.

Nozzle diaphragms and buckets are made of materials very difficult to grind, and require a 32 microinch finish. To provide such a finish, it is standard practice to use relatively coarser grits such as 80 and 120 with aluminum oxide cloth belts and resin on resin bonding.

Ex-Cell-O Corporation has developed a series of machines which take a rough forging and mill it all over, followed by hard wheel grinding and a coated abrasive belt machine which progressively polishes and removes the tool marks left by the machining operation. The machine is entirely cam-controlled and is not dependent on operator skill.

Fillet Grinding and Polishing

The fillet area of a jet blade or bucket is the area between the foot and the upright section of the part. Unfortunately, it is the cause of a large percentage of rejects in production. Many manufacturers machine the foot as a unit and the blade or bucket as a separate unit; the fillet area is the joining area which must blend into both. This area is ground and polished freehand. Development of automatic machines is complicated by the fact that the upright area is not always centered over the foot, which eliminates it as a reference point; also, the tolerance variation in blade thickness, which may be ± 0.003 in., precludes the use of positive cam control.

A narrow abrasive belt can be used in conjunction with a contact wheel of small diameter—in the neighborhood of ¼ inch. Some manufacturers have built narrow-belt machines using rubber-covered contact mandrels in conjunction with a belt idler and tensioning unit. This method gives longitudinal grit lines, which are desirable.

Another machine, semi-automatic in operation, is made by Ex-Cell-O for use on forged blades which have first been machined all over. It uses a ½ x 60-in. coated abrasive belt of 180 or 320 grit, running over a formed rubber contact wheel. The workpiece is tracked against the belt by a plate cam which is turned by a hand wheel, so that the profile, fillet and platform areas are ground accurately, and through as many passes as the operator desires.

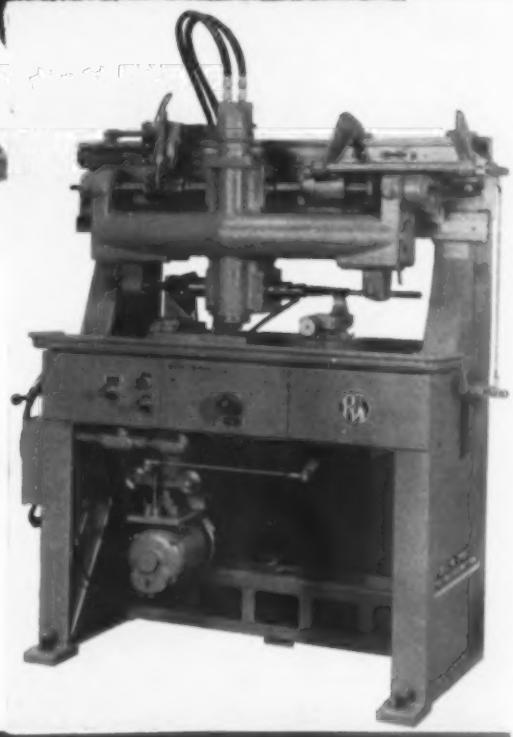
Jet blade manufacturers themselves have developed a variety of special machines, one of which is an automatic machine adapted from a rise-and-fall miller, using a coated abrasive belt to produce the required dimensions and finish in the fillet and platform areas of the jet blade. These particular machines usually process only one side of the blade at a time and require an accompanying machine for the second side. Machines of this type are designed to minimize the skilled hand labor necessary to produce the required part.

Other manufacturers have made special machines of their own for producing longitudinal lines in the fillet and platform area, using a jet of compressed air which forces the coated abrasive belt against the work to accomplish the necessary polishing operation. Prior to this

HAMMOND 6-STATION longitudinal blade polishing machine moves the blade between pair of formed rubber pads. Abrasive used is in 50-yard roll form, up to 4 inches in face width. Table reciprocates work. Production: 550/hour, one operator.

polishing operation, the desired profile or shape can be placed in the fillet and platform area using a formed type of wheel; the air jet machine with coated abrasive belts simply changes the direction of the grit lines at the critical stress point of the jet blades.

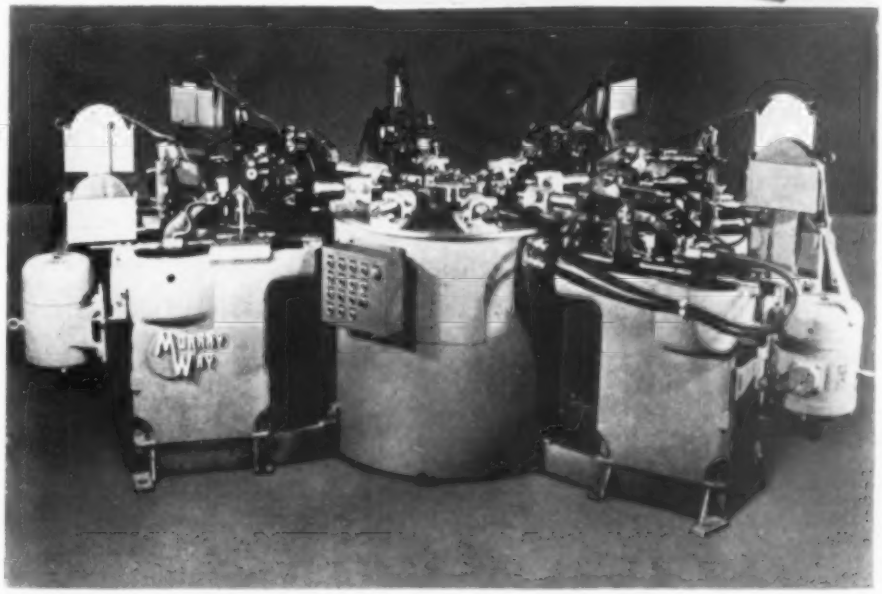
The ideal machine for this process has yet to be developed, because of the forging tolerances and warp angle tolerances involved.



PRATT & WHITNEY machine uses 5/8 by 90 inch cloth belts of 50-grit aluminum oxide with all-resin bond to generate desired blade or bucket shape from master cams. Machine forms desired edge radius on both edges, removing .020 to .090-inch stock from oversize forging. Grinding is done with lubricant oil for better performance.

Leading and Trailing Edge Machines

On precision-forged blades, a machining operation is employed to bring the blade down to proper width. This operation leaves a flat edge, both leading and trailing, which must be radiused accurately. The correct radius can be put on the jet blade parts by a free-hand method using a contact wheel and in some cases a fully automatic machine which uses a free belt over which the blade is wiped to give the desired radius and contour. Machines of this type are capable of an output as high as 500 pieces



MURRAY WAY SIX-STATION longitudinal polisher in which blade remains stationary while polishing head with its contact pads and abrasive is moved rapidly back and forth to do polishing. One operator can produce 600 blades per hour.

continued

per hour with unskilled labor. The necessary high finish on these parts can be obtained easily by selection of the correct grit, which is approximately 180.

Among the machines developed to impose the edge radii, one by Acme Mfg. Company attains production with unskilled operators between 250 and 800 pieces per hour.

A Pratt & Whitney machine is being used by some manufacturers for putting the radius on the leading edges of jet blades which are curved. Production is not as high as with the other machine described, but it has been selected for work on blades with curved edges.

Ryman Engineering Co. of Ellwood City, Pa., has developed a machine which automatically rotates a blade in a holder against an abrasive belt running over a contact wheel. The contact wheel backs up the abrasive belt at the line where the grinding is performed.

Many machines use ordinary double-spindle contact wheels for free-hand finishing. One operator polishes the part and puts a radius on the leading edge; the second operator puts a radius on the trailing edge and, if necessary, brings the part down to its correct chordal width.

Longitudinal Polishing

The overall high finish, which on jet compressor blades is 16 microinches or less, is produced by longitudinal polishing on automatic rotary type machines. In this particular application, coated abrasive roll stock, again of aluminum oxide cloth, is used typically in a grit sequence of 100, 120, 150, 180, and 220.

The stock is pressed against the work by fitted rubber pads which press upon the back of the abrasive strip; with the abrasive oiled and the blade holder given a reciprocating motion, this produces a high finish by a crushing and burnishing operation. This burnishing action is similar to the method used to produce high finishes on automobile crankshafts. Operation of these machines is entirely automatic, and one operator can produce 400 or 500 finished blades per hour.

This particular operation is not a corrective grinding technique; as usual, the last operation must give the longitudinal lines necessary to prevent fatigue cracks from developing when the part is operating in a jet engine. Longitudinal polishing, a relatively inexpensive process, is coming into widespread use before the final forging operation or coining to give an overall clean-up to the surface of the jet blade before final forming.

Hammond Machinery Builders has developed five- and six-station longitudinal blade polishing machines. This machine moves the blade between a pair of formed rubber pads which back up the coated abrasive rolls.

Murray Way Corporation has produced a six-station longitudinal blade polishing machine in which

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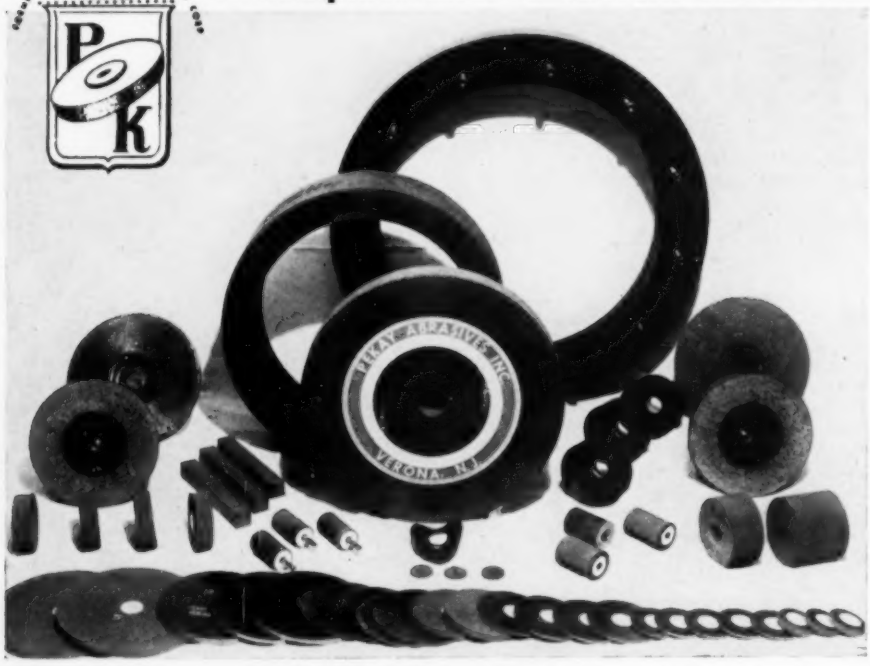

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BADER OFFHAND machine for blades and buckets. It may be used with contact wheels from 2 to 14 inches in diameter with same belt speed.

the blade remains stationary while the polishing head with its contact pads and abrasive is rapidly moved back and forth to do the polishing.

Acme Mfg. Corp. has developed a seven-station machine which longitudinally polishes blades. The blades are held in a vertical position and moved longitudinally between a pair of formed rubber pads which press the abrasive against the blade to polish it.

Also used for polishing are machines which, with automatic unloading, can finish blades at rates up to 1500 per hour. These machines are used in forge shops only.

There is a definite trend toward the use of longitudinal polishing of buckets as well as blades.

Titanium is coming into widespread use for the cold compressor end of jet engines because of its great strength for small cross-section. Titanium presents a difficulty in that it is easily heat-checked—a condition which may not show up until the blade receives its final inspection before shipment.

The use of coated abrasive belts which can be operated at very low surface speeds with sharp-cutting characteristics, plus the proper lubrication, helps to speed the processing of titanium parts. Titanium has one drawback: the momentary temperature at the grinding point may approach 1200 to 1500 F, at which heat the titanium has an affinity for abrasive grain. Use of slow speeds with the proper coolant insures success in this particular operation, so that the problem of grinding titanium is not now as serious today as it was once thought to be. The choice of the abrasive grit to be used on titanium varies among manufacturers, for both aluminum oxide and silicon carbide are used, depending on the application.

Offhand grinding of titanium, or spotting out of defects, is usually performed with silicon carbide grain, whereas the pressures encountered in a machine such as the Pratt & Whitney 9-in. turbine blade grinder require the use of aluminum oxide, whose grains have more of a triangular shape which withstands the high pressure of hard contact wheels. The use of a lubricant, preferably a grinding oil, helps to prolong belt life on titanium metals.

All manufacturers of jet blade parts, for both the cold and hot ends of the compressor, are seeking to build automatic machines which do not require skilled labor to produce the complex part needed. Finish requirements on parts for jet engines are very high. Accordingly, it is quite certain that with any such machine designed in the future, coated abrasives will play an important part. • • •

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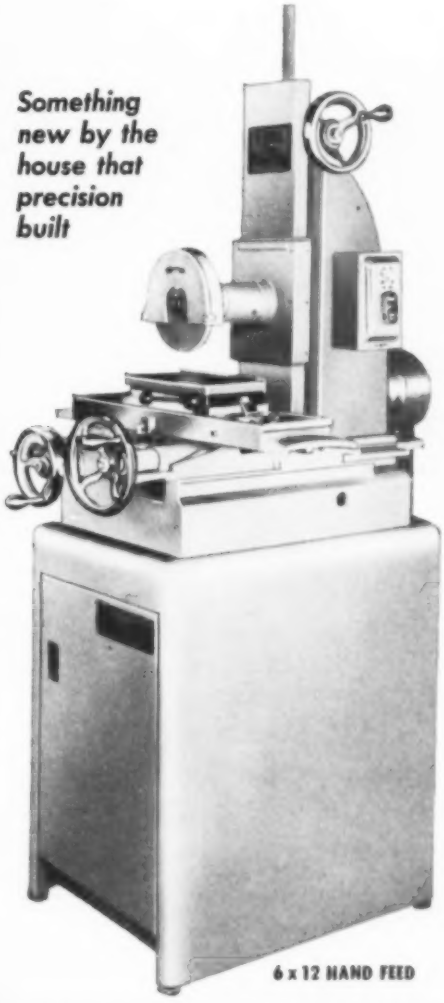

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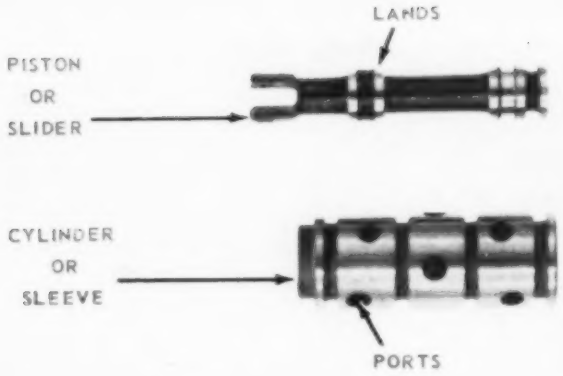

FIG. 1—MATCHED SERVO-VALVE cylinder and piston. Piston lands are ground to match cylinder ports. Final grind requires accuracy within .0001-in.

New Technique Grinds Servo Valves Within One-Tenth Tolerances

• New precision grinding techniques are used to match vital aircraft servo valve pistons and cylinders within a .00010 inch accuracy to assure instantaneous valve response in operation of air-craft control surfaces. Use of the new method has stepped up production rates as much as double on servo valves for Chance Vought jet aircraft. Overall costs have also been cut in the manufacture of these high pressure hydraulic system assemblies.

The servo valve is the key to the operation of the vital airfoil surface actuating system which controls the direction of high speed aircraft in flight. It is made up of two basic parts —the cylinder or sleeve and the piston or slider.

Precision machined ports in the sleeve and "lands" on the surface of the slider must be matched to specifications, Fig. 1. Past experience on similar jobs indicated that the precision forming and matching of these two parts was the most critical factor in their production.

Previous attempts to produce interchangeable parts were not fully successful. Rejects were high and the amount of regrinding required on both parts proved prohibitively high in cost.

This production routing utilizes Multiform grinders that shape the circumferential contours from alloy bar stock with Crushtrue abrasive wheels and machine the ports by the ultrasonic method using Cavitron equipment. The critical final grind-to-match utilizes a Model 121-C Micro-Form grinder with an extended work table and tandem optical system. (Fig. 2)

The finish grind is accomplished through simultaneous optical comparison of each cylinder port and its corresponding piston land. The slider or piston is ground at position B in figure 2. The ports of the matching cylinder are simultaneously viewed through the other scope at position A to determine the depth of grind required by the operator at B. This final grinding operation matches the lands on the slider to the ports on the sleeve.

Before utilization of this high precision grinding technique, both parts had to be ground, imposing a double production load. Under the new setup, only the slider or piston is ground and the first matching grind is usually sufficient to pass the assembled flow test. Any that do not pass are reground in the same machine, using in-process air gage control, permitting .00010 inch accuracy. Usually only one regrind is required to pass inspection. • • •

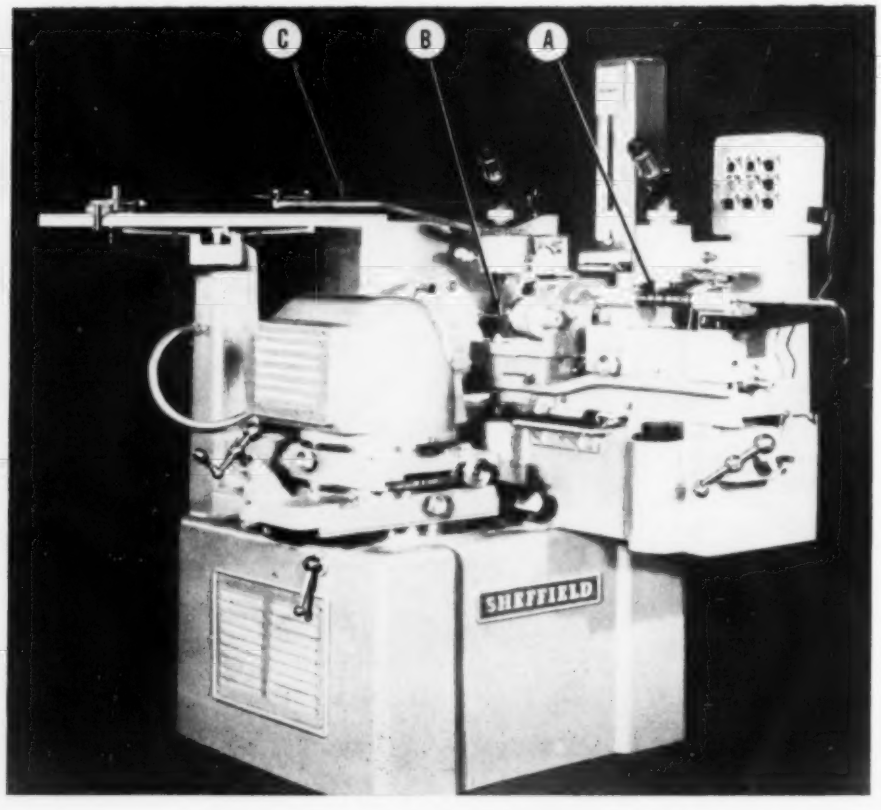

FIG. 2—SHEFFIELD 121-C Micro-Form grinder used for the final grind. Note position of the cylinder reference piece at (A) and the piston being match ground at (B). A 50 to 1 pantograph with vernier adjustment is at (C).

Pratt & Whitney Announces Numerical Control for Vertical Hole Grinders

- *Blueprint information fed directly to machine*
- *Positioning accurate within .0001-inch*
- *Toolroom-type grinders suitable for production*

● The development and perfection of a wholly new system of numerical control as applied to jig borers, vertical hole grinders and rotary tables has been announced by Pratt & Whitney Company, Inc. It is believed to be the nearest approach yet devised toward complete automation of machine tools of this type by making possible automatic accurate positioning within one ten-thousandth of an inch. Vital machine tools that formerly could be used only as toolroom equipment can now be made available for efficient volume pro-

AIRCRAFT JET ENGINE production will be implemented by Pratt & Whitney's numerically controlled vertical precision hole grinder built for Ford Aircraft, Chicago. In photo below, units are: control cabinet (left), hole grinder (center), control panel. Cabinet (right) contains tape into which digital information has been punched to automatically position workpiece.

Why NEW "150" HYDROHONER Is Economical . . . Compact . . . Standardized

Basic Micromatic "150" Machine, suitable for both internal and external Microhoning.

Now, even manufacturers with limited capital can afford Microhoning . . . with all its benefits including efficient stock removal, accurate geometry and controlled surface finish. The new Micromatic "150" Hydrohoner is the answer!

Because it is standardized and produced in quantity, this quality machine is economical. (Special engineering is limited to tooling and fixturing.) The design and quality of the "150" assures performance equal to more expensive honing machines. It has a 12" stroke and Microhones diameters up to 1½" . . . yet requires just 34" x 52" of floor space.

The Micromatic "150" is ideal for the manufacturer with limited capital, short production runs or a need for standby equipment. Immediate delivery from stock on basic machines.

The principles and application of Microhoning are explained in a 30-minute, 16mm, sound movie, "Progress in Precision"... available at your request.

☐ Please send me "Progress in Precision" in time for showing on_____(date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

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Numerical Control

continued

duction purposes.

Under the numerical control system, all blueprint data needed for locating, indexing, boring and grinding is stored on punched tape and translated directly into mechanical action by the machine. The system actually feeds blueprint information directly to the machine. Chief advantages of this system are:

1. Elimination of human error in reading or setting dials or verniers.
2. Ability to rapidly set all slides and verniers simultaneously.
3. Reduction of scrap losses and consequent cost reduction.
4. Increased operating speeds and efficiency.
5. Minimum setup time.
6. Constant precision since the machine is automatically controlled.
7. Fewer jigs and fixtures.
8. Faster cycle times resulting from automatic operation.

Punched tapes are easily and economically prepared, and take the place of costly and complex fixturing. Thus, automatic programming and operation become practical for short production runs and for the machining of one or two pieces with multiple holes at a minimum of operator fatigue.

In addition to the advantages of any automatic control system over conventional operator control, numerical control has demonstrated important advantages of working with highly accurate Electrolimit measuring systems which are capable of settings accurate to .0001 inches, or five seconds of arc.

The system is based on the common decimal system (decimal of an inch and decimal of a degree of arc), and the dimensions shown on a blueprint are punched on tape as easily as numbers are tabulated on an adding machine. This decimal system eliminates the necessity of making complex mathematical translations which are required by automatic control systems based on binary numbers.

For its tape reader, Pratt & Whitney selected a design which uses a pneumatic sensing system. Air is forced through holes in the tape to an enlarged chamber with a neo-

DIGITAL INFORMATION punched into tape automatically positions table. Dimensions shown on a blueprint are punched on tape as easily as numbers are tabulated on an adding machine.

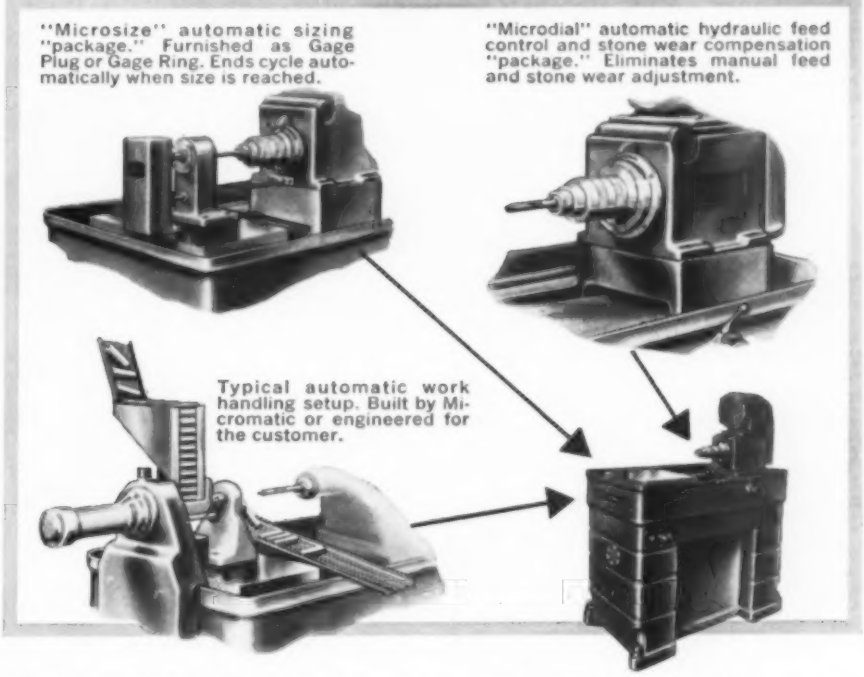
prene diaphragm which provides enough force to operate an industrial control limit switch.

The tape is moved into position and stopped automatically. It is at the stopping point that all data on the tape necessary for a single operation is read at one time and presented automatically to the machine. When the machine operation has been completed and checked, the tape can be advanced one block so that new information may then be presented.

Many measuring systems were studied in an effort to determine the one most suited to its new precise positioning system. It was known in advance that one machine tool required a total movement along one axis of 60 inches and it was necessary to be able to set that slide to an accuracy of .0001 inches.

It was decided that the most practical approach to a measuring system would be to break the problem up into several lower accuracy digital-to-analog converters with proper bench marks for refining the accuracy as the successive settings were made. This philosophy was well suited to the Electrolimit measuring system which has been used successfully for a number of years on their manually-operated jig borers. This system uses a measuring bar which has accurately located magnetic lugs at one inch intervals combined with a micrometer screw for adding distances of less than one inch. • • •

How NEW "150" HYDROHONER Can Be Automated to Any Degree . . . Easily . . . Economically


"Microsize" automatic sizing "package." Furnished as Gage Plug or Gage Ring. Ends cycle automatically when size is reached.
"Microdial" automatic hydraulic feed control and stone wear compensation "package." Eliminates manual feed and stone wear adjustment.
Typical automatic work handling setup. Built by Micromatic or engineered for the customer.

The basic Model "150" Hydrohoner is a new, standardized and economical Microhoning machine . . . priced for manufacturers with limited capital or relatively short production runs.

The basic machine features automatic stroking and hydraulic initial tool expansion and collapse. Various degrees of automation can be easily added at any time to the basic machine as required by individual manufacturers' needs. Micromatic "package units" which provide specific automation functions are illustrated. Design of this basic horizontal machine and its stationary bridge facilitate addition of these "package units". For complete automation of the "150" Hydrohoner, Micromatic will build automatic work handling devices or assist users in designing their own automation of work handling.

Send coupon for complete information.

Learn how Microhoning will give efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

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☐ Please send Micromatic literature and case histories.

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Why Grandmother!

Stories on grinding wheel problems—just like the kind you tell the youngsters—can have a happy ending. And we're writing new ones day after day for plants where high grinding wheel costs and low production have been wolfing up profits.

If *you* are ready to "cry wolf," let us send CINCINNATI (PD)° WHEELS to the rescue. For *now* CINCINNATI Grinding Wheels offer POSITIVE DUPLICATION—a remarkable achievement in precision manufacturing and quality control that can *save you money—and increase your production.*

Through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

So, if grinding problems have you ready to shout for help, just contact your CINCINNATI Grinding Wheel distributor. Or, contact us direct and we'll send one of our representatives —men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone—Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

Remember—*only* CINCINNATI Grinding Wheels give you . . .

(PD) POSITIVE DUPLICATION

CINCINNATI° *Grinding Wheels*

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

°Trade Mark Reg. U.S. Pat. Off.

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GRINDING safely

by **Edmund Mottershead,** President
Mottershead Associates, Chicago

● Abrasive grinding wheels of one kind or another are probably the most universally used tools in all industry. Because the wheels are used by many people, some of whom have had no training in their correct use, the list of reported causes of injury from grinding wheels is long and varied.

The most common cause of injury is failure on the part of the operator to use proper goggles or face shield. Another prime element in personal injury from grinding operations is wheel breakage, but this, in turn, is traceable to a number of factors including improper handling and storage of the wheel, failure to test the wheel, improper mounting, use of unrelieved or unmatched flanges, failure to use blotters, running with the wheel out of balance, or incorrect dressing of the wheel.

Holding the work improperly, or having the work rest improperly adjusted can lead to getting work or fingers caught between rest and wheel face. Lack of wheel guards or wheel guards not properly adjusted for the wheel allow injuries to occur which are entirely needless.

Side grinding on wheels not designed for the purpose, taking too heavy a cut, applying the work too quickly to a cold wheel, using excessive wheel speed, and grinding too high above the center line of the wheel are signs of either untrained or careless machine operation.

It is well to remember that wheels can be broken from a lack of power as well as from other causes. If a wheel slows down materially while the work is being applied, insufficient power is reaching the spindle. Belt slippage, the use of too small a motor, or line voltage drops may account for this. However, when the wheel slows down, the operator tends to use more pressure, thus setting up stress within the wheel which could cause breakage.

RESINOID DISC, backed-up by rubber supporting pad, operates at high speed in this grinding operation performed on soot blower rails. Operator is fully protected by face shield, gloves, adequate light on the job so he can see what he is doing. Note flexibility of grinding disc which permits some bending at edge under operating pressure. Wheel can still break if this is overdone, however.

SMALL HIGH-SPEED air driven grinder operates at r.p.m. sufficient to develop surface speed capable of making cutting action of grinder efficient. Half-round guard is sufficient to protect operator in case of wheel breakage. Short spindle with wheel mounted close to chuck holds down endplay and whip, reduces chances of breakage due to spindle bending or breaking.

Work pressure, if excessive, can cause both poor grinding and danger for the operator. Spindle fractures can occur well below the critical speed of the unit. Ordinarily, the work pressure will not be excessive unless an attempt is made to force the wheel beyond its cutting capacity. An experienced operator can tell whether the wheel is cutting freely. If the wheel causes burning of the work, excessive pressure is the likely cause, especially with small diameter spindles. A softer grade of wheel would permit necessary stock removal without the excessive pressure. Following manufacturer's ratings and specifications as to the right wheel for the right job and the correct operating speeds for the wheel will eliminate much trouble in this area. • • •

Maximum Automation Potential

PREDICTS BEFORE CAPITAL INVESTMENT

Metal removal costs too high?

Carborundum's new M-A-P Method gives you a chance to compare the advantages of coated abrasives

Maximum Automation Potential is a metal removal prediction method—predicts cost savings and production increases with the use of abrasive belts on your present or planned production operations. M-A-P is a *new* engineering service provided by The Carborundum Company. Now you can *compare* the advantages of using abrasive belts on either heavy metal removal or on the finishing or semi-finishing operations of any component part you manufacture.

M-A-P metal removal recommendations are made for you by Carborundum's coated abrasives engineers at the Carborundum plant. A study is made of your specific operation based on a few simple production facts which you provide and an M-A-P recommendation *is mailed to you* without cost or obligation—gives you the opportunity to *know* what savings can be expected *before* making a material or equipment change.

M-A-P predictions are based on facts accumulated through Carborundum's many years of abrasive experience and the abrasive machinery know-how of its Curtis Machine Division. These abrasive facts have been developed into M-A-P formulas—new positive standards for every factor which enters into grinding metal with abrasive belts.

To determine *your* Maximum Automation Potential with abrasive belts write for the M-A-P Brochure which explains this new service to industry in detail. Address inquiries to: Dept. 45 M-A-P, Senior Coated Abrasives Engineer—

The **CARBORUNDUM** Company

COATED ABRASIVES DIVISION

Niagara Falls, New York

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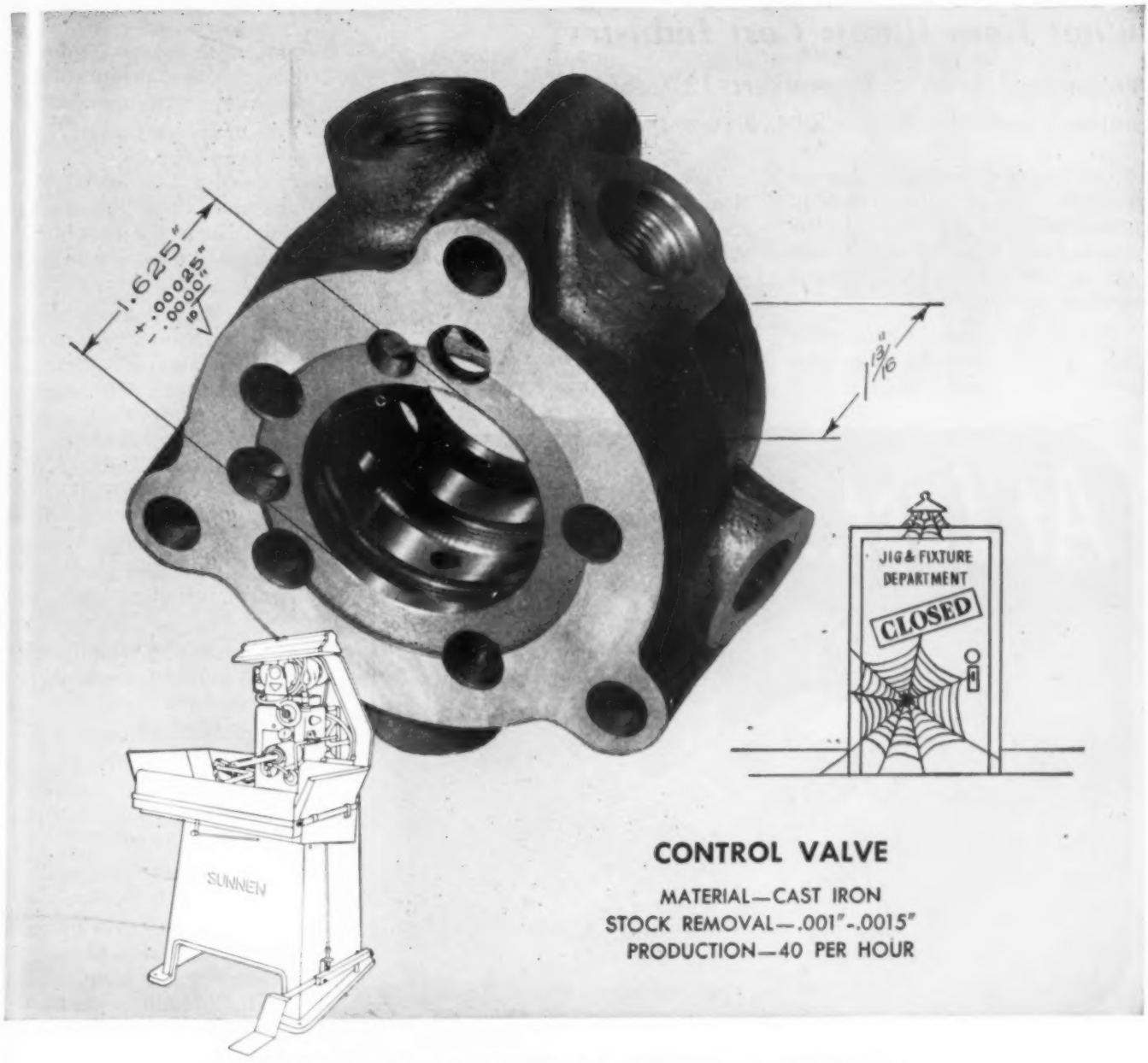

CONTROL VALVE

MATERIAL—CAST IRON
STOCK REMOVAL—.001"-.0015"
PRODUCTION—40 PER HOUR

GET DISTORTION-FREE BORES
WITH FIXTURE-FREE HONING

With Sunnen Honing as your final bore-sizing process . . . the workpiece is free and uncramped. No holding fixtures are used! The finished bore will not change shape—immediately or later—as there is no stress to relieve.

Savings are substantial—no fixture cost, no set-up time, no loading or unloading.

Sunnen Honing gives you perfect control of stock removal, size and finish at all times. Errors of previous hole machining operations are corrected once and for all.

With Sunnen Honing you're equipped to produce precision holes of nearly any diameter and length combination . . . in practically any shape part . . . small lots or production runs.

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What Does Illness Cost Industry?

Prolonged illness costs workers 13% of yearly income, nation's annual toll is billions, 5-year study reveals

● Prolonged illness and absence from the job costs employees in private industry 13 per cent of their annual income—a total of $800 million in lost wages, plus personal medical expenses.

Almost $2 billion in production time is lost annually from this cause.

This was disclosed by publication of the results of a five-year study of non-occupational illness by the Research Council of Economic Security, Chicago. The study also revealed that prolonged illness struck employees at the rate of 39 per 1,000 on the payroll. Financed by grants from private industry, the massive study cost more than $250,000 and covered 193,856 employees of 145 firms, both in manufacturing and non-manufacturing industry.

Of the employees studied, 6,201 had prolonged illnesses, defined as lasting more than four weeks. Average duration of these illnesses was 10.9 weeks. Size of the firms ranged from under 500 to more than 5,000 employees.

Cost of prolonged illness-absenteeism to the nation, to industry, and to individuals reaches into the billions. All statistics were carefully weighted according to the 1950 Census. The study disclosed the following estimated costs of prolonged illness among the current population of 52.4 million non-farm workers only:

More than $1 billion paid out in sickness compensation and paid sick leave.

Medical costs of $700 million, of which $266 million is medical payments by workers.

A total of 2,043,600 cases of prolonged illness-absence per year.

Average production loss is 8.6 persons (full time) for a full year per 1,000 on the payroll.

Production lost is the work of 453,000 men for a full year.

"To plan action to meet this production loss, we need to look at more of the specific findings," the study said. "The rate of prolonged illness-absence is greater among women workers than among men; greater among production workers than among salaried personnel. It rises markedly by age. From this we can conclude that production lines are hardest hit; that experienced workers, in whom there is an investment of training and whose skills can least be spared, are more frequently absent."

Published under the title of "Prolonged Illness-Absenteeism," the study was conducted by the Research Council. The Council's research director, Leon Werch, is responsible for the design and carrying out of the survey, as well as for writing the final report.

"The toll of prolonged illness is inescapably heavy," the study said. "In addition to the production time lost during the prolonged absences

(Continued on page 65)

A Coolant that Won't Stain Aluminum!

INTERNATIONAL 131-A

For grinding and cutting aluminum, International 131-A out-performs on every count. This stain-free coolant does not discolor aluminum or its alloys, nor does it react with aluminum dust. A superior finish is assured. In addition, the need for wheel dressings is greatly reduced . . . tool life is substantially increased.

It will pay you to use International 131-A—one of a complete line of non-staining International coolants and cleaners formulated especially for aluminum and other non-ferrous metals.

Write for information today

Specialists in Cleaners and Coolants for Over 50 Years

I.C.C. INTERNATIONAL CHEMICAL CO.
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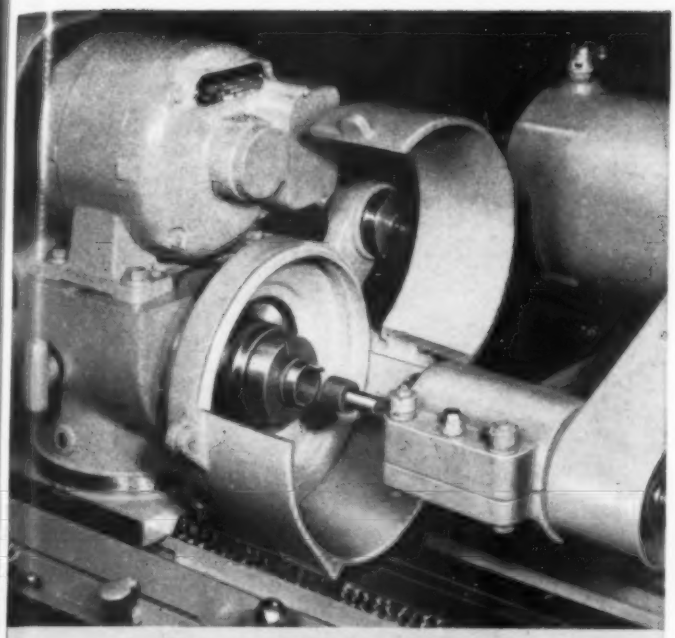
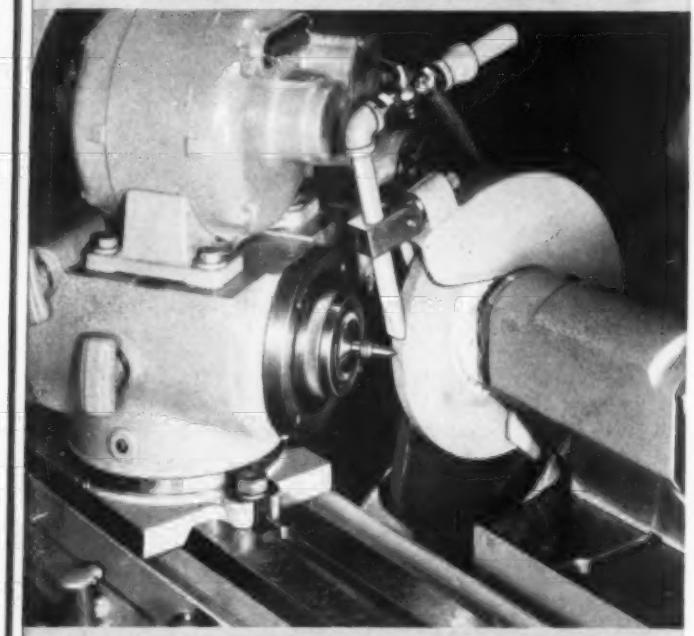
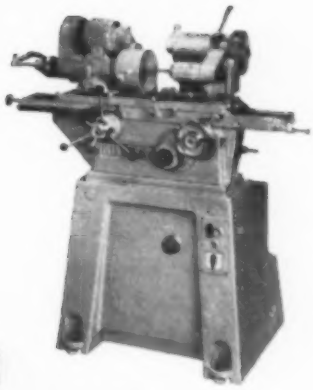


Grinding a straight hole with the work held in a step chuck.



Grinding sharp taper on metering needle held in collet with workhead swiveled 30°.



AN INTERNAL SPECIALIST WITH EXTERNAL ABILITY!

Rivett Model 84. The New Small Hole Grinder With The Greatest Popularity Gain!

Combines inherent accuracy with broad flexibility for faster handling of your diversified jobs. Mounts interchangeable wheelheads for internal and external spindles. Hole and external capacities are 3″ diameters, maximum depth 4″. Collets and step chucks mount directly in lathe-type spindle.

All details to prove are in Catalog 84A. Write for your copy today!

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INTERNAL & EXTERNAL GRINDERS

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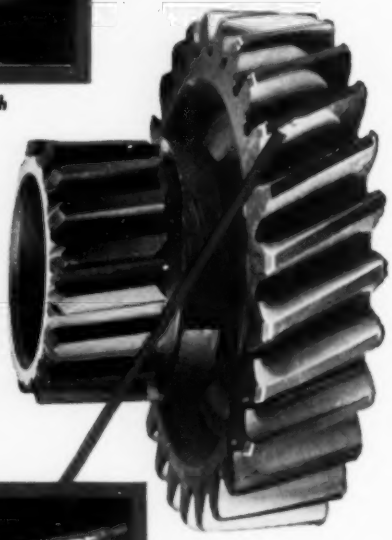
RED RING
HARD GEAR HONING
PRODUCES QUIET GEARS

Nicked Gear Tooth



Same Gear Tooth After Honing

Hard gear tooth honing is an entirely new approach to the vexing problem of intolerable gear noise arising from nicks, burrs, tooth roughness and minor heat-treat distortions.

Honing is not only far more effective than other processes used to combat gear noise but it is also much more economical. And it produces none of the undesirable after effects inherent in other processes such as heat checks, soft skin or residual stresses in the tooth metal.

Gear honing does four important things:

- Smooths off the swaged or raised metal surrounding tooth nicks.
- Eliminates burrs.
- Materially improves surface finish.
- Corrects minor heat-treat distortions in profile, index and lead.

When used as a final routine finishing operation following heat-treat, it eliminates the tedious and costly operation of searching for nicks and then correcting them. It improves the quality, uniformity and performance of all gears produced.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

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Patents pending

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IMPORTANT: For your convenience this sheet is perforated. Tear it

IMPORTANT: For your convenience this sheet is perforated. Tear it out and "buck-slip" it to the proper man in your plant.

Centerless Grinding Wheels and Regulating Wheels by Carborundum are job-engineered. The *right* combination of abrasive grain and bond assures top operating efficiency. A typical centerless grinding sequence is reported on the back of this page. Compare these figures with yours.

Ask the man from **CARBORUNDUM** REGISTERED TRADE MARK **BONDED ABRASIVES DIVISION**

Also makers of a complete line of Coated Abrasives and Abrasive Grain

ATTENTION GRINDING FOREMAN: Turn the page and study the Product Performance Report written especially for you.

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Product Performance Report

HYDRAULIC VALVE LIFTER BODIES

Millions of valve lifter bodies are required annually for the automotive industry. These precisely ground and finished parts are produced at rates as high as 3500 pieces/hr./machine. To produce these parts, which are finished to a size tolerance of .0003", wheels and machines must be right. Stock removal rates run the gamut, from .025"/pass and better in the roughing cuts to .0005"/pass in the finishing passes. Wheels must furnish maximum number of pieces per dressing and produce high quality work to close limits. A typical centerless grinding sequence for grinding valve lifter bodies before machining and heat treating follows:

Pass #1 24 x 6 x 12 WC465-P4-VD
14 x 6 x 5 A60-R2-R
Stock removal = .004 -.032"

Pass #2 Same wheels
Stock removal = .024"

Pass #3 24 x 6 x 12 A60-N5-V10
14 x 6 x 5 A80-R2-R
Stock removal = .015"

Pass #4 20 x 6 x 12 A60-N5-V10
12 x 6 x 5 A80-R2-R
Stock removal = .003"

PROVE IT YOURSELF. You can get the ***exact*** results you want in centerless grinding . . . in precision, rate of cut, and output. A complete survey of your operations will show you the specific grinding and regulating wheels you need.

NOTE: Carborundum, leader in abrasive techniques, backs up its products with trained sales representatives, a staff of competent field engineers and an abrasive engineering laboratory . . . all available to you to put more sense in your abrasive dollar.

Here is another in the series of Product Performance Reports being released by the Bonded Abrasives Division of The Carborundum Company. A color photograph of this actual operation is shown on the back of this page.

• *Ask your local distributor . . . or the man from*

CARBORUNDUM
REGISTERED TRADE MARK

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Prolonged Illness

continued

from work, there is, of course, the cost of medical care. Based on the average costs reported for the absences studied, the annual bill for medical care for the projected number of illness-absences is approximately $700 million.

"The principal impact of prolonged illness-absence upon the worker is the loss of earnings for the period of absence. The gross wage loss represents 68 per cent of the total prolonged absence cost . . . For the average absentee in the study, the total net cost—after payment of group plan benefits: medical care, sickness compensation, and sick leave—was equivalent to 13 per cent of his normal earnings . . .

"How the absentees met the net costs can best be indicated by their answers to the questions asked. Almost 41 per cent said that they drew on savings that had been intended for the purchase of a house, a car, or some major household appliance, such as a refrigerator or washing machine. Presumably there were that many less houses, cars, or appliances purchased. About 19 per cent stated that they arranged to pay their bills—hospital, doctor, clinic, etc.—on a deferred or installment payment basis. Sixteen per cent borrowed to pay their debts."

Subjects covered by the study include rate of absence, duration and severity of prolonged illness, medical data on the types of illness, medical care, costs to individuals, industry, and the nation, and the role played by insurance protection. The survey had the endorsement of the American Medical Association, American Hospital Association, Blue Shield Commission, Blue Cross Commission, and the Health and Accident Underwriters Conference. Sponsoring and participating firms, foundations, and associations totalled 281.

Other findings of the study include:

Rate of prolonged illness-absence increases by age, with the 55-64 brackets having six times as many as the youngest group, 14-24.

The rate for production workers was higher than for salaried workers, the former being 44 per 1,000 and the latter 30 per 1,000.

Women had more prolonged illness-absences than men, the rates being 51 per 1,000 for women and 32 per 1,000 for men.

Non-manufacturing industry had a higher rate (43 per 1,000) than manufacturing industry (35 per 1,000).

Ninety-three per cent of the absentees returned to work after their illness.

Prolonged illness accounts for 35.3 per cent of all time lost from the job because of illness. It is 60 per cent of the time lost during all absences of one week or more.

Hospital care was needed by 75 per cent of the cases (29 per 1,000) and the average hospital stay was 2.5 weeks.

Fewer than half (18 per 1,000) needed surgical treatment.

The median wage of the employees covered by the study was $3,485 annually. Gross average costs were $717 in lost wages and $342 in medical costs. Average net

Automatic Holding Power Control

ASSURES TOP MAGNETIC CHUCK PERFORMANCE

NEUTROLATOR

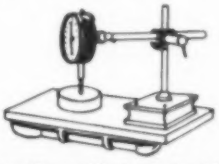
No More Shimming!

Electro Magnetic Chuck Control provides regulation of holding power which permits grinding without shimming, to close flat parallelism than ever before possible.

In production grinding where holding power must be the same with each work piece, NEUTROLATOR produces the same tension on each successive piece without readjustment.

Where various tensions are required, a simple dial or pushbutton controls holding power adjustment.

NEUTROLATOR affords complete control of electro magnetic chuck at all times and protects chuck from harmful voltage surges.



Flat Parallel Grinding

Where absolute Flat Parallel grinding is a necessity, NEUTROLATOR should be considered a necessity.

Easy Removal of Work!

When work is completed, NEUTROLATOR demagnetizes both chuck and work piece. No resistance—no marred work or chuck surfaces.

Contact Your Equipment Supplier or Write:

ELECTRO-MATIC PRODUCTS CO.

2237 N. KNOX AVENUE CHICAGO 39, ILLINOIS

TELEPHONE: BELMONT 5-4010

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DI-MET

Carbide Microinch Finisher

The answer to low cost finishing of carbide and ceramic cutting tools!

Produces ½ to 6 microinch finishes in 2 minutes or less!

Here's what micro finishing of cutting tools can do for you!

1. Increases tool life from 200 to 700%
2. Raises cutting speed (sfm) 50 to 100%
3. Increases feed and depth of cut 50 to 100%
4. Decreases surface roughness of parts 100 to 500%

The DI-MET Carbide Microinch Finisher employs two Meehanite cast iron laps. Impregnated with DI-MET Diamond Compound, these laps can be used in sequence for fast rough lapping and finish lapping, or when both are impregnated with same grade of diamond compound, can be used simultaneously for finishing with double the output.

DI-MET DIAMOND COMPOUND

A *better* lapping and finishing compound that won't throw off under centrifugal force, that polishes faster and easier, and that produces uniform finishes free from scratches. Water soluble for ease of cleaning and changing grades. A demonstration will prove its extraordinary value!

ANOTHER PRODUCT OF FELKER RESEARCH

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Ask for free folders on the DI-MET CARBIDE MICROINCH FINISHER AND DI-MET DIAMOND COMPOUND!

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Prolonged Illness

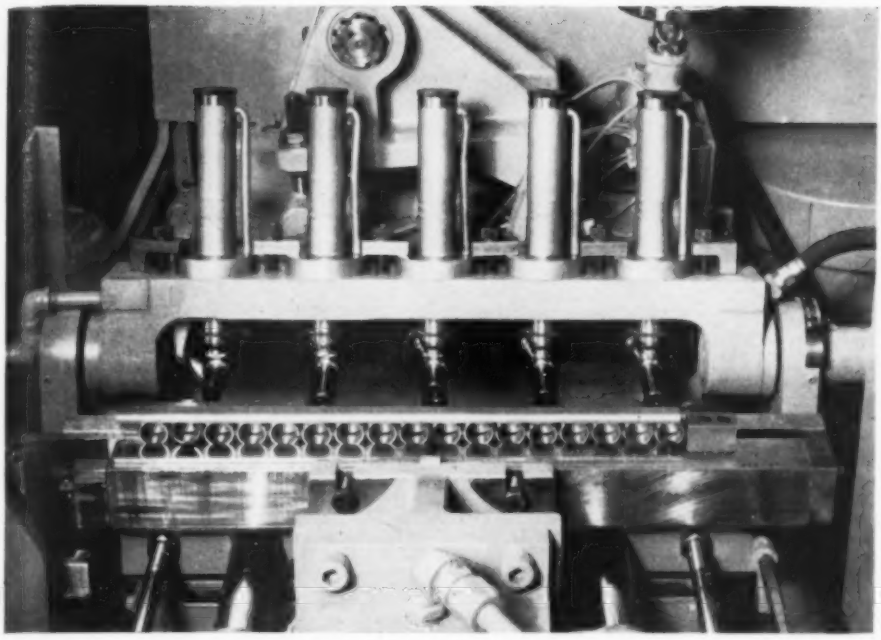
continued

wage loss was $323, which is 9.3 per cent of income. Average net medical cost was $129, which is 3.7 per cent. The study showed medical costs to be higher for men than for women, higher for older workers, and higher as the income level rose. Hospital charges formed 51.7 per cent of total medical costs and physicians' fees 38.5 per cent, for a combined total of 90.2 per cent.

"There are some problems in present benefit provisions," the study noted in commenting on insurance coverage now in force. "The heavy emphasis is on hospitalization and surgical care. Almost 71 per cent of the benefits go for hospitalization and a little over 24 per cent for surgical care. That leaves only 5 per cent for physicians' fees, for other than surgical care, for nursing services, and for all the other ancillary needs. As a result, the present benefits succeed in meeting 80 per cent of the hospital charges and 61 per cent of the surgeons' fees, but only 16 per cent of all the other charges. The total accomplishment of the group plan benefits is 62 per cent of the total gross medical care costs."

The study disclosed that the diseases which affected the workers were the everyday type, which affect everyone. The greatest number, 23.6 per cent, was affected by ailments classified as Diseases of the Digestive System, such as hernia, appendicitis, ulcers, and like diseases. Diseases of the Circulatory System were next with 12.9 per cent of the cases, with Accidents, Poisonings, and Violence third with 11.1 per cent.

"Whenever and wherever illness strikes, it is costly," the study concludes. "When the illness is serious and the period of disability prolonged, particularly for the wage earner—faced with both the loss of income and the medical care cost—the financial burden may well be insurmountable. Occurring in any number, this becomes a serious problem for the employer, for the community, for the nation. With these cases multiplied by the thousands across the nation we, indeed, are faced with a basic social security problem." • •



CLOSEUP of inner race machine. Tapered arbors can be seen directly below the tool bridge.

Honing Ball Bearing Raceways

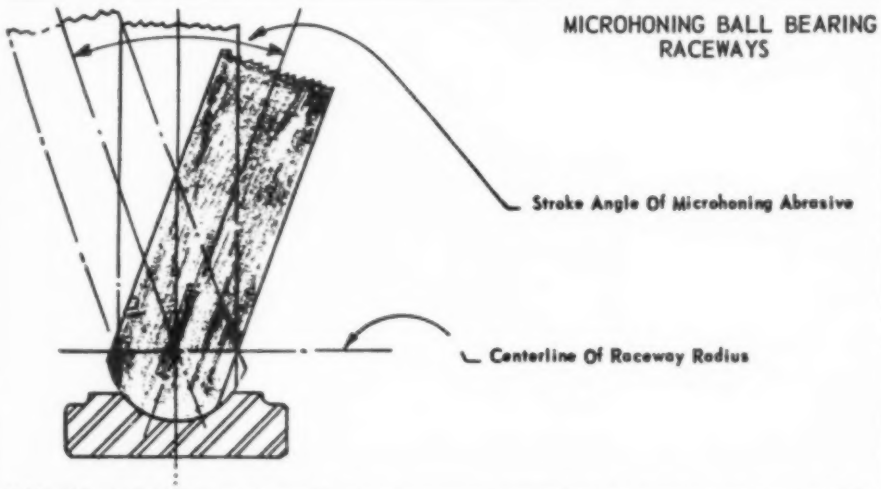
Now a production reality in three major ball bearing plants, Micromatic Hone's raceway finishing method represents an automatic processing advance. Both inner and outer races can be handled.

• Both inner and outer raceways for ball bearings are now being honed on a new line of multiple spindle machines developed and manufactured by Micromatic Hone Corporation, Detroit. This represents a "first" in the anti-friction bearing industry, being the first time that a successful method has been developed for automatic final finishing and handling of raceway rings on multiple spindle machines.

The machines are designed with either 3 or 5 spindles, depending on the bearing size. The entire operation is automated, including automatic loading and ejection, automatic cycling, and automatic feeding of the abrasives. The machine stops automatically when abrasives require replacing.

With the steady increase in demand for ball bearings, automatic

(Continued on next page)



HONING ABRASIVE stick pivots about raceway centerline to generate a true radius.

COOLANT or GRINDING COMPOUND PROBLEMS?

here's your Solution

INTERNATIONAL REFINING & MFG. CO. ACCRUS EVANSTON, ILL. U.S.A.

NOW you can...

- produce low micro-finishes with 60 grit grinding wheels —EXCELUS MICRO FINISH Grinding Compound;
- accomplish deep draws without fractures or wrinkling — INTERNATIONAL DRAWING COMPOUNDS;
- hob gears without oily floors, undesirable working conditions—NEW ACCRUS;
- draw No. 40 B&S magnet wire at 5000 FPM trouble free—ACCRUS No. 4.

43 Years Old - BUT NOT Old Fashioned!

Our products are time tested and modernized to meet today's requirements.

Our field engineers work with industry, solving critical production problems through proper use of coolants, lubricants and drawing compounds.

What are your problems?

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1914 — 1957

EVANSTON ILLINOIS

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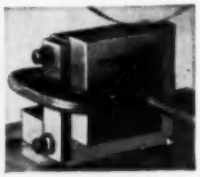
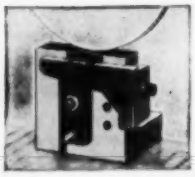
LASSY MASTER V-BLOCK

ANGLE PLATES

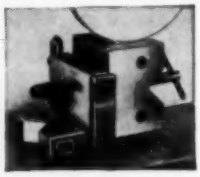
This Master V-Block Angle Plate is an improved new design. Saves hours of setup time. Assures precise work accuracy. Requires less skill.



Side Gage automatically squares work precisely and without removing angle plate from chuck. Repetitive accuracy maintained.



Adjustable parallel holds the smallest work for position and clamping with ease and accuracy.



LASSY MASTER Angle Plate provides a master setup for regrinding of worn or inaccurate Angle Plates.

WRITE FOR DESCRIPTIVE LITERATURE

LASSY TOOL COMPANY

PLAINVILLE, CONNECTICUT, U.S.A.

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WALLS TU-WAY BELT SANDER

Full 1/3 h.p. G. E. Motor

USE IT EITHER WAY

At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

complete with cord, plug, switch ready to use **$89.95**

Illustrated Literature on Request

A few desirable distributor territories still available.

WALLS SALES CORPORATION

333 Nassau Avenue Brooklyn 22, N. Y.

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LEFT, TALYROND chart of ball raceway of inner race finished by old method. Right, Talyrond chart of Microhoned raceway curvature. Charts are 2000 to 1 magnification. (Each division on the radial lines equals 50 millionths of an inch.)

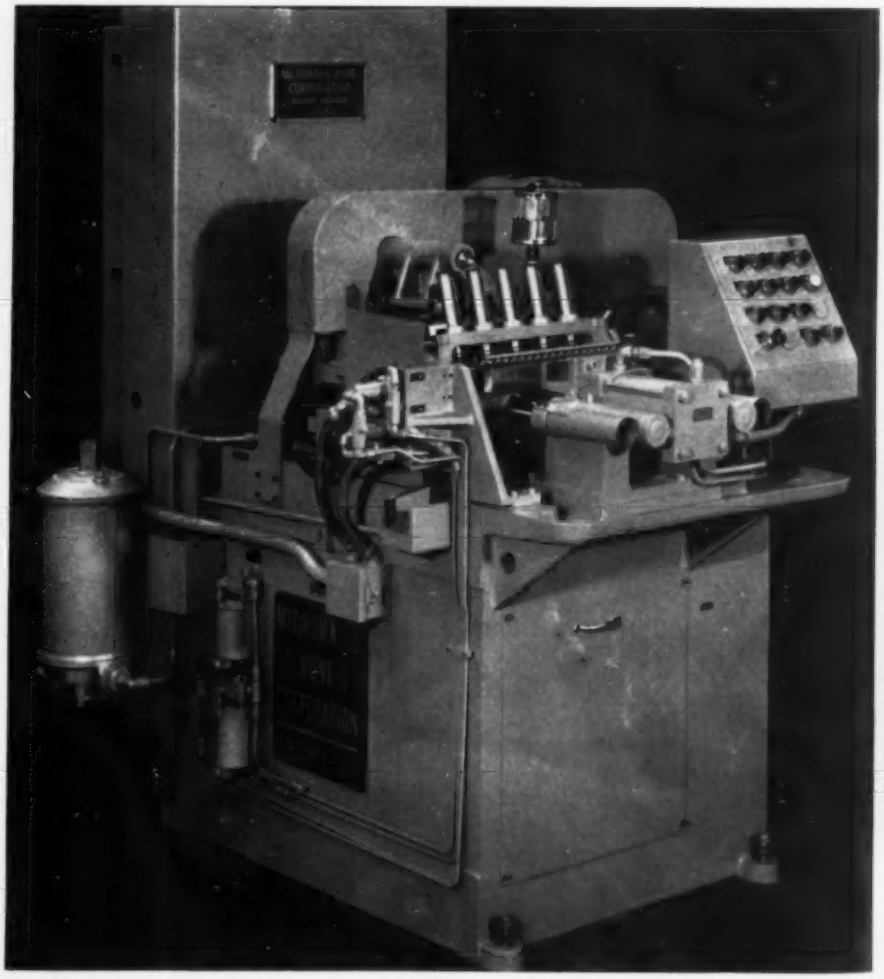
handling and processing have become necessities in keeping quality up and costs down while meeting the demand for increased bearing production.

The quality of any bearing is no better than the surface on which the ball rolls. Slight imperfection in the raceway means increased friction, noise and reduced bearing life. The noise that a bearing makes when rotated under load is not only an indication of how smoothly the ball is rolling, but is also an important factor in itself . . . especially in components such as electric motors used in home appliances wherein the noise must be kept at a low level.

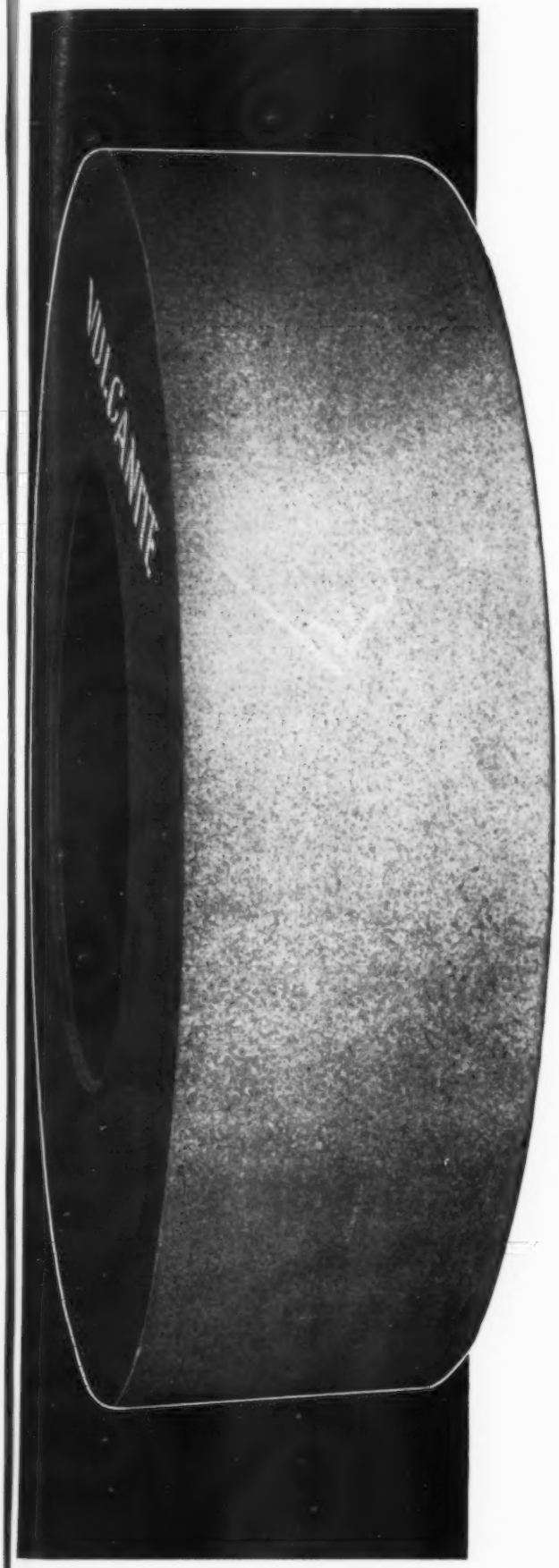
Critical functional characteristics of the raceway include:

a. Curvature across the raceway
b. Macrogeometry (waviness)

(Continued on page 70)



FIVE-SPINDLE machine designed for Microhoning raceways of inner rings. Automatic loader and ejector is in front of the tool bridge.



US RUBBER Centerless Work Wheel

Withstands stresses that would break down the ordinary wheel!

This porous rubber-bonded wheel will
(1) take roughing and finishing cuts from "dead soft" to high Rockwell carbon, as well as work hardenable, alloy, or tough stainless steels.
(2) absorb vibration in tube grinding and impact on off-size or distorted pieces.
(3) grind with uniform temperatures.
(4) reduce number of wheel changes and wheel inventory.

Specify U.S. Wheel No. A60-05-RA9. It has done the above jobs for many manufacturers—and will do the same for you.

EXTRA DIVIDEND: Remember that when you buy wheels from United States Rubber Company salesmen, you are dealing *direct* and are being served by a specialist—a man whose only job is selling and *servicing* abrasive wheels. He will see that you get maximum value out of your abrasive wheel dollars. Write Grinding Wheel Sales Dept., U. S. Rubber, 4300 New Haven Ave., Ft. Wayne 4, Ind.

US RUBBER **Mechanical Goods Division**

United States Rubber

Use postpaid card. Circle No. 242

around the raceway

c. Microgeometry (surface roughness and lay) of the raceway.

Bearing manufacturers outlined their production problems to Micromatic Hone Corporation and asked if Micromatic research engineers could develop production equipment for honing ball raceways. Initial study of raceway geometery, with its torus-shaped surfaces and lack of standard specifications for the surfaces, indicated a need for special instruments to study and analyze surface characteristics.

Three instruments were added to Micromatic's engineering laboratories for this purpose. These were (1) A Talyrond, which charts the geometric form of a surface, (see Grinding and Finishing, September 1956, p. 36), (2) A Waveometer, which indicates average waviness of the surface on dials reading in microinches r.m.s. The Waveometer also contains an oscilloscope which shows the number of waves on the circumference of the raceway, (3) A Rotopiloter for checking surface roughness at right angles to ball travel.

The next step was to examine the results obtained with the old methods of finishing the ball track. A number of bearings were purchased from local suppliers. These were taken apart and studied.

With this background, equipment was designed to generate the proper functional characteristics on raceways, by adapting the basic principles of Microhoning: (a) a combination of motions that generates true geometric form and keeps the abrasive sticks self-dressing; (b) low velocity abrading with controlled pressure; (c) a float in the tool that allows the abrasive to align itself with the neutral center of the raceway.

Tapered arbors are used for the small inner rings, and end-clamping arbors for larger sizes. The parts are pressed on the arbor and then pulled against a plate that locates them in relation to the tools. The tools are mounted on an oscillating bridge that pivots about the true center of the raceway arc. As the ring rotates, the abrasive sticks sweep across the tracks removing irregularities and leaving a surface that is free of smeared or deformed material.

During the major portion of the timed cycle the bridge oscillates rapidly to give full coverage of the raceway and remove stock rapidly. The speed of oscillation is then automatically reduced, so that the finished track has all abrasive marks running circumferentially around the track.

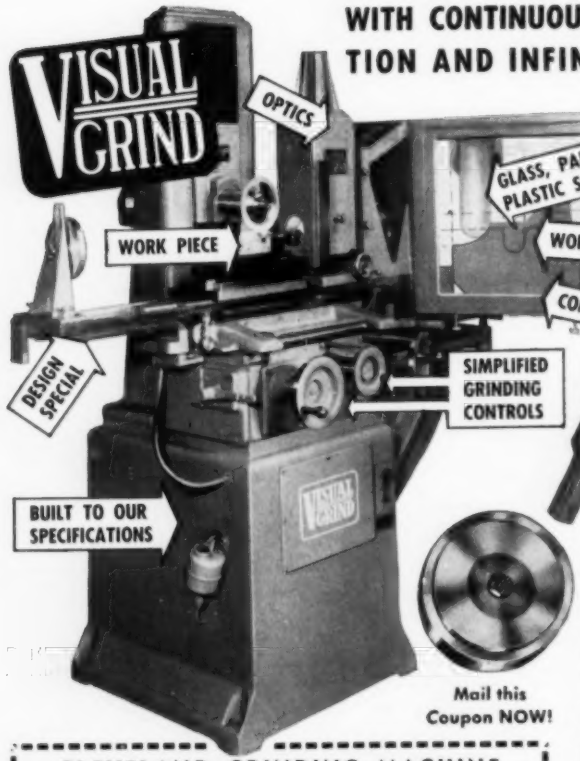
Outer rings are held in chucks that locate them from the O.D. and clamp on the side faces. The motions and cycling are the same as on the inner rings.

Production on a 5 spindle Microhoner, finishing No. 8 inner bearings, is 500 rings per hour. Using 3 spindles for the outer rings of the same bearing, production is 240 parts per hour. This will vary with the size of the bearing and the condition of the rings as they come to the machines. • •

TOP FIRMS SHOW

PROVED SAVINGS UP TO 75%

IN SET-UP AND GRINDING TIME WITH CONTINUOUS WORK INSPECTION AND INFINITE PRECISION



SIMPLIFIED OPERATION

When working with TUNGSTEN CARBIDE, STAINLESS STEEL, STELLITE or TOOL STEELS, VISUAL GRIND permits a semi-skilled operator to grind precision pieces without continued checking with the comparator. Automatic inspection is accomplished with the built in optical comparator.

Visit our plant . . . let us show you how VISUAL GRIND will speed production — cut costs.

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Gentlemen:

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Grinding and Finishing

Free Literature

Use the postpaid card opposite page 72 to receive your copy of any of the literature listed on these pages. Just circle the proper number on the card and mail it. We'll do the rest.

Machine Tool Catalog

Written with the machine tool buyer in mind, Catalog No. M-1961 contains 72 colorful pages which illustrate and describe the company's complete lines of milling machines, broaching machines, grinders, grinding wheels, cutting fluid, selective hardening and metal forming machines, and special machine tools.

The Cincinnati Milling Machine Co. and Cincinnati Grinders, Inc., Cincinnati 9, O.

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Coated Abrasives

Brochure entitled "Maximum Automation Potential" explains free engineering service of the Carborundum Co. M-A-P is a new method, devised to predict performance of abrasive belts on any metal removal operation (except snagging) in advance of any expenditure for materials or equipment.

M-A-P studies are made by Carborundum away from the customer's plant. Abrasive belt recommendation is based on a few basic production facts.

Coated Abrasives Div., Carborundum Co., Niagara Falls, N.Y.

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Directory of Tooling Services

A 68-page pocket-size directory of special tooling services offered by NTDMA members lists approximately 1000 contract tool and die plants throughout the United States and Canada. Information given includes company name, address and telephone number; names of individuals to contact; specific products and services offered by each association member.

These include: large, medium, small, progressive, lamination, and carbide dies; dies made of plastics; press brake, forging, and diecast dies; plastic, rubber, powdered metal, and permanent molds; standardized punches and die inserts; die sets and accessories; jigs and fixtures; jig and fixture parts; cutting tools; hobbing; engraving; duplicating machine work; jig boring; jig, thread, and special grinding; special machinery; rebuilding machinery; metal stampings; machining service; tool engineering and design; experimental and model work; instruments and mechanisms; standard and special gages; special cams.

National Tool & Die Manufacturers Assoc., 908 Public Square Bldg., Cleveland 13, O.

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Surface Measuring Instrument

The Proficorder is a mechanical-electronic instrument which provides a permanent magnified chart record of the shape, height, and spacing of surface irregularities, including long waves, bows, and nonsymmetrical profiles such as steps, plateaus, peaks, and grooves. It shows the profile of most machined or finished surfaces, external or internal, permits tracing widely varied surfaces at various magnifications.

The instrument consists of these three basic units: tracer, Pilotor, and Amplicorder. The tracer is a differential transformer type transducer. The Pilotor supports the tracer and provides tracing motion. The console Amplicorder contains the electronic system, the chart recorder, and provides mounting space for the Pilotor.

Folder from Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich.

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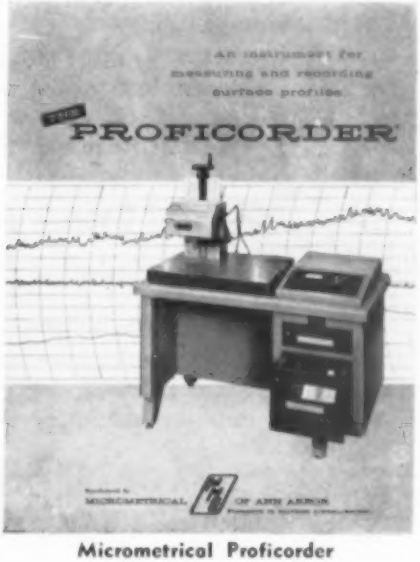
Cincinnati machine tool catalog



Micrometrical Proficorder

Precise

SUPER 40 CUTS OPERATION COST 44%

On Carpenter's Level at STANLEY TOOL CO.
NEW BRITAIN, CONNECTICUT

Our Case History M-101

PROBLEM: To route out casting flash and to de-burr center areas of carpenter's aluminum level.

FORMER METHOD: Hand filing.

PRECISE METHOD: One PRECISE Super 40 Grinder Miller mounted in inverted position under work bench, with T.C. Midget Mill projecting above work surface.

RESULT: A much better, smoother finish and actual cost reduction of 44%!

PRECISE GRINDER MILLERS
Modern Industry's Most Versatile Power Tool

Only PRECISE offers all these features:

Super Speeds up to 45,000 RPM.

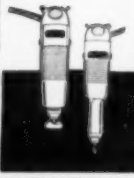
Powerful ¼ H.P. output at precision ground and honed collet chuck, up to ¼" size.

Strong, one-piece aluminum alloy housing, precision machined on inside and outside.

Suited for hand grinding and milling as for mounted applications on standard machine tools.

Complete line of machine tool mounts and accessories available.

Send for Free Catalog containing our complete line of Grinder Millers and Power Quills from ⅕ to 1½ H.P. and their amazing adaptability to modern day precision production.



Precise

PRECISE PRODUCTS CORP.
3735 BLUE RIVER ROAD, RACINE, WIS.

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Make accurate set-ups *faster* with this 25° Tilting Spindle

The STERLING Model "G-2" Universal Tool and Cutter Grinder provides this extra feature plus complete versatility and more capacity than comparable machines at *lower cost.*

Swing 10¾" over table, 27" between centers, 18" table travel with 8¼" cross feed. For complete details and specifications write for FREE Bulletin "G-2".

Grind 90° to 140° Included Angle on *ALL DRILLS*, ⅛" to 2½"

No collets or chucks makes set-ups easy. Clearance gauge insures accurate, positive clearance angle. True conical grinding produces full clearance from center to outside. Write for FREE Bulletin "DV-1".

McDONOUGH MFG. CO.
1522 GALLOWAY • EAU CLAIRE, WISC.

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Free Literature

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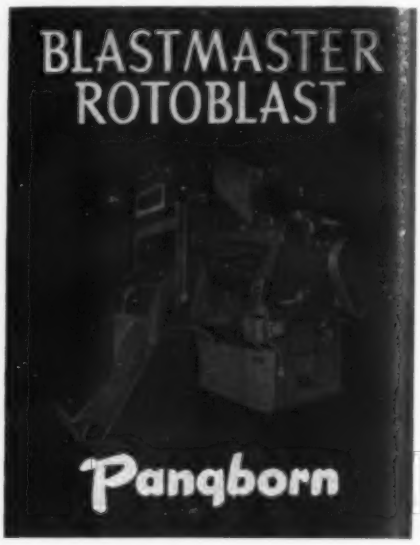

Blast Cleaning

Automated techniques for high speed blast cleaning, construction features of Rotoblast units, layout aids, and a special section on abrasive coverage are presented in 20-page reference bulletin No. 703. It carries complete specifications and dimensions for all Blastmaster barrels, from 1½ cubic feet to the 27 cubic foot size.

Blastmaster—designed to take full advantage of the newest premium abrasives—is used for blast cleaning of castings, forgings, and heat treated parts. Dimensional plan views and silhouette drawings of all machines are given as well as the maximum weight per piece for cleaning maximum weight per load, and motor specifications. Chart illustrates the various types of automation operations which can be adapted to high-speed cleaning applications.

The Pangborn Corporation, Hagerstown, Md.

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Snap and Hole Gage Sets

Two Multi-Gage sets—adjustable snap gage and hole gage—are presented in flyer. Snap gage range, 0 to 2"; hole gage range, 7/16" to 4". Larger sizes also available.

Ten thousand gages at your fingertips, manufacturer claims. No time need be lost waiting for special snap or plug gages. Easily adjustable to split tenth accuracy using gage blocks or micrometers; can be locked and sealed in a few minutes. Gaging surfaces are hardened, ground and lapped, and can be relapped easily when worn.

American Standard Co., Plantsville, Conn.

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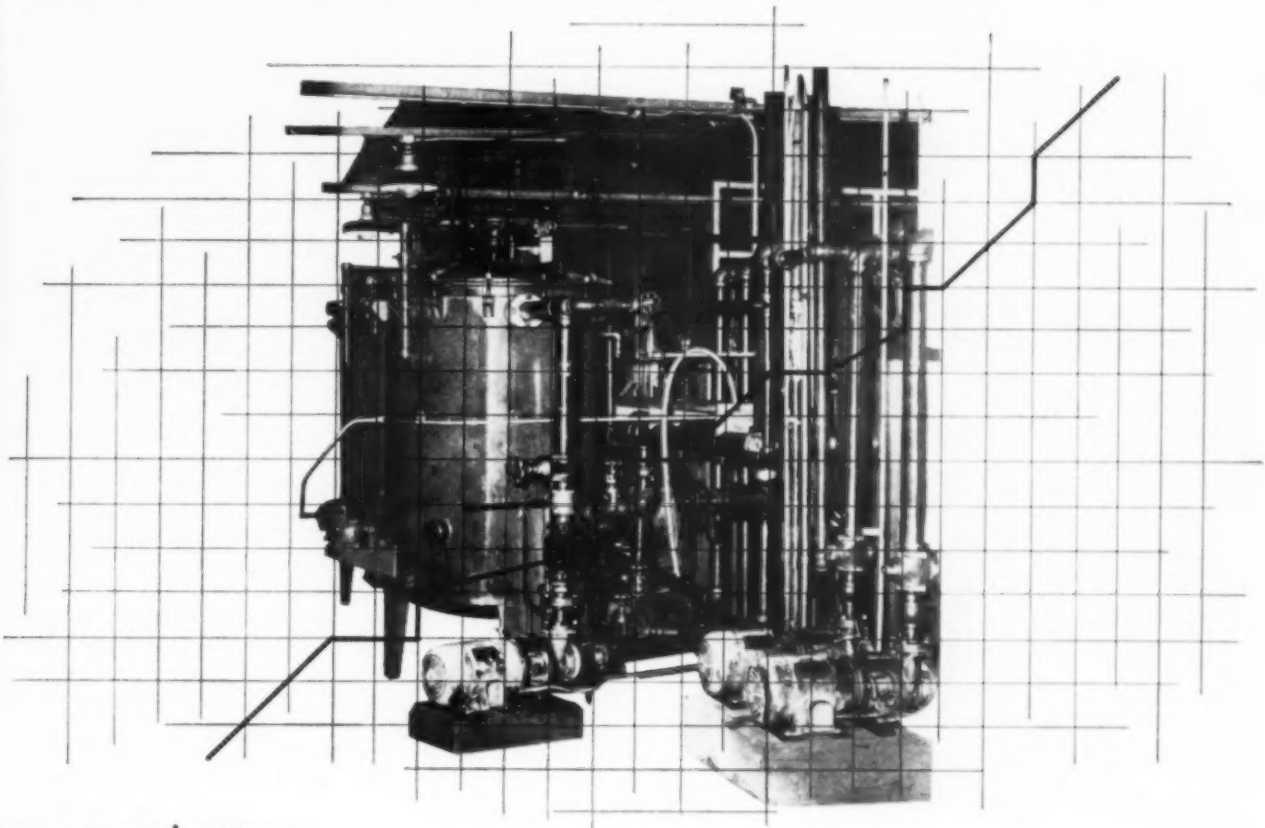
Hoffman engineered systems get **results:**



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HOFFMAN COOLANT FILTRATION SYSTEM

did for TAYLOR INSTRUMENT COMPANIES...

Before Hoffman installed their centralized coolant filtration system, Taylor Instrument Companies of Rochester, N.Y. estimated that over the coming year they would enjoy:

- A 15% increase in tool life.
- A 10% increase in productivity.
- A saving on cutting oil of 3,000 gallons per year at 75c per gallon.
- A saving on dual-purpose cutting and lubrication oil of 2,000 gallons a year at 50c a gallon.

After one year of operation Taylor had experienced these actual results:

- Tool life increased 30%—15% over the original estimate.
- Productivity increased 15%—5% over the original estimate.
- Saving on cutting and lubrication oil exceeded $3000 a year.
- Sumps cleaned every three to four months instead of every 3 to 4 weeks; flushing system totaled less than 25% of original cost, including labor.
- Machines ran longer between tool grinds.
- Tool-wear tolerance-loss cut sharply.
- Tool-grinding staff reduced by one-third—a saving not even estimated.
- Longer production runs—more units per shift; operators enthusiastic about working with clean coolant.
- More work absorbed by same facilities, floor space and personnel.
- Sizable reduction in tool inventory.

Get the full remarkable story on Taylor's increased production, lowered costs and stepped-up efficiency. And find out how Hoffman engineered systems can get **results** for **you!** Write for free bulletin: **B12**

INDUSTRIAL FILTRATION DIVISION **U.S. HOFFMAN MACHINERY CORPORATION** Dept. GF, 103 FOURTH AVENUE, NEW YORK 3, N.Y.

INDUSTRIAL FILTRATION DIVISION Machine Tool Coolant Clarifiers—Flotation, Mechanical, and Magnetic. Lubricating and Insulating Oil Conditioners, Filters, and Vaporizers. Solvent Recovery Systems—Vacuum Stills and Filters. **ORDNANCE EQUIPMENT DIVISION** Special Pneumatic Conveying Systems. High Efficiency Centrifugal Separators. Stationary and Portable Vacuum Cleaning Equipment. Process Equipment. Pneumatic Systems for Radioactive Materials. **AIR APPLIANCE DIVISION** Multistage Centrifugal Blowers and Exhausters. Pneumatic Conveying Equipment. Industrial Vacuum Cleaning—Portable and Stationary Systems. Continuous Metal Strip Driers. "Smoothflow" Fittings and Tubing.

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continued

Convex Radius Grinder

This convex radius grinder can grind either the right or left side of a cutter to a 90° radius, or it can grind a full 180° convex radius. Total setup and machining time (including rough and finish grinding) for the average milling cutter is less than one hour. Form dressing of the wheel is eliminated.

Nassau Tool Work, 208 Meacham Ave., Elmont, L.I., N.Y.

Use postpaid card. Circle No. 7

Gear Honing

Bulletin H-57-2 describes the new Red Ring gear honing process, which improves sound qualities of hardened spur or helical gears by removing nicks and burrs, improving surface finish, and correcting minor heat treatment distortions. Recommended practice for applying the process is outlined in detail.

The Model GHB gear honing machine is described in detail. Bulletin also contains specification tables for 8-in. and 12-in. machines. Abrasive-impregnated gear-shaped honing tool and the particles removed from tooth surfaces by the honing process are illustrated.

National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich.

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Surface Grinder

Catalog No. 332 describes the No. 18 grinder, the most generally used size and type of Blanchard grinders. The work is laid on the rotary magnetic chuck (30 and 36 inch) and the switch closed. The operator touches the traverse control and the chuck is moved by power horizontally to bring its center under the face of the cylinder wheel. In this position the chuck is rotated continuously, the water inside the wheel is turned on, and the wheel head is gradually fed downward, by hand or power, until the desired size is reached. Metal is removed by a rapid succession of very shallow cuts over the entire face of the work.

Range: 36″ dia. x 12″ high over 30″ chuck with cylinder wheel—11″ high with segment wheel; 36″ dia. x 12″ high over 36″ chuck with cylinder wheel—11″ high with segment wheel.

Blanchard Machine Co., 64 State St., Cambridge 39, Mass.

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Height Gage

Super vernier height gage with chrome finish in 12″, 18″ and 24″ sizes, are subject of Form No. M25. Extra long vernier plate is easily read. Offset arm with integral marker makes measurements to zero possible. Marker is two-way type, making it possible to contact a measuring surface either from above or below with direct reading and without withdrawing marker.

Brown & Sharpe Mfg. Co., Providence, R.I.

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Materials Handling

Folder shows the use of Rapistan gravity and power belt conveyors in various industrial operations. The bulletin, Form IND-1, contains photographs of conveyors being used in receiving, work in process, warehousing, shipping, packaging, order selection, and other areas. The use of basic packaged conveyor units, portable lines, and controlled flow systems is described.

The Rapids-Standard Co., Inc., 342 Rapistan Bldg., Grand Rapids 2, Mich.

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ARTER *Convertible*

Internal-Cylindrical

GRINDER

This versatile production or tool room grinder can be used as prime equipment or as an auxiliary to larger machines.

Dual purpose — Internal or Plain Cylindrical — by simply changing wheelheads. This low-priced grinder, designed for work where small-in-capacity machine is needed, is proving an exceptional investment for many grinding operations.

It will do the same for you.

ARTER GRINDING MACHINE COMPANY

WORCESTER 5, MASSACHUSETTS

Jigmatic Automatic Tape Controlled Positioning Table • Rotary Surface Grinders
Flat Circular Cutter Grinders • Internal Grinders • Cylindrical Grinders • Carbide Tool Grinders

AGENTS IN INDUSTRIAL CENTERS OF UNITED STATES AND CANADA

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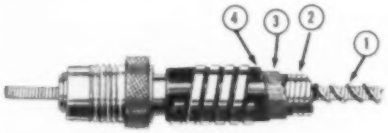
New Hand Tool Gives Tool And Die Maker More Efficient Performance

At the Modern Tool and Die Company, Cleveland, extremely close tolerances are a constant requirement in the daily production activities. Workmen must have hand grinding tools which provide cool operation over long periods, vibration-free performance, flexibility and efficiency in use, and minimum handling fatigue.

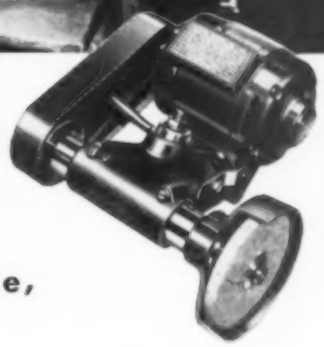
According to the Shop Foreman, the latest hand tool that has all these advantages is the Dumore Super-Flex shaft tool. "We like it because it takes all our ¼" and ⅛" shank tools and performs extremely well on our close tolerance tool and die work. Even after day-long use, worker fatigue is practically non-existent. It has cool operation and is vibrationless. The 22,000 rpm output gives us ample speed for clean, fast, precision metal removal. It is the handiest, most efficient hand tool we have."



BUILT-IN EFFICIENCY

Bronze liner encircles the shaft (1) which acts as a bearing and confines rotation within a definite radius. It prevents vibration, whipping and acts as lubricant to the shaft. The armored wire casing (2) is surrounded by wire braid (3) for further insulation and covered with neoprene (4) which is oil, grease and water resistant. For further information on the Super-Flex and other precision hand tools, write to the Dumore Company, 1326 Seventeenth St., Racine, Wis.

Low Cost Precision Grinding Machines



made possible with versatile, all-purpose SERIES 5

DUMORE TOOL POST GRINDERS

MOUNTED ON USED MILLER BASES, the Series 5 Dumore Tool Post Grinders provide manufacturer, Scully-Jones, Chicago, with dependable high production precision grinding equipment at amazingly low cost.

As the plant manager says, "Over many years' use we have learned to expect very close tolerances, low scrap and trouble-free operation from our Dumore Grinders. The extremely low depreciation, maintenance and set-up costs make this unit one of the most satisfactory tools in the plant. As long as Dumore Grinders and serviceable used machine tools are available we need never lack for precision grinding equipment."

Series 5, Dumore Tool Post Grinder, ½ hp distributed field, continuous-duty rated universal motor. Speeds from 4600 to 42,500 rpm for wheels from ⅛" to 5". Performs a wide variety of internal and external grinding jobs at high production rates. Accuracies to .0001" and surface finishes of 6 to 8 micro-inches. For lathes with 13" to 18" swing . . . and . . .

Mounts on any basic machine tool — planers, shapers, mills, grinders, lathes — to provide precision grinding equipment at low cost. Simplified mounting makes change-over quickly — and speeds re-converting to original machine, when required. You can improvise, too, to make low cost special machines for special jobs!

Eight other models available, 1/5 to 3 hp, for every size of basic machine and type of grinding job. For complete details, write for Catalog 55-FL.

WARNING: If you own a Dumore Tool Post Grinder — don't let it sit idle in your tool crib! It's the most versatile, useful tool you own. Put it to work **now** — you'll save money and get better results!

SOLD THROUGH LEADING DISTRIBUTORS EVERYWHERE

You can do more grinding with Dumore Grinders on **any** machine tool!

DUMORE

PRECISION TOOLS

AUTOMATIC DRILL UNITS TOOL POST AND HAND GRINDERS

1326 Seventeenth Street, Racine, Wisconsin

Use postpaid card. Circle No. 248

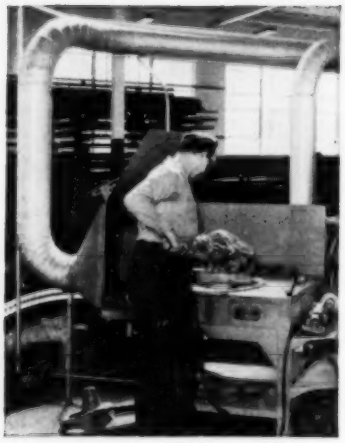
AIR IN MOTION KEEPS MEN IN MOTION

Dusty or fume-laden air can curtail production and increase maintenance costs by dulling worker efficiency and damaging bearings, motors . . . even machines.

Efficient K & B Dust Control Systems put AIR in Motion to become an important production tool.

In the plant of a noted chain and forging firm, an official made this comment about a new K & B installation: "Our workmen can now work full time . . . this means added production for them and for the company as well."

Call on K & B engineers to put *AIR in Motion* and help boost your plant efficiency. The Kirk & Blum Manufacturing Company, 3124 Forrer Street, Cincinnati 9, Ohio



K & B system serving castings grinding removes dust, sand and chips as fast as they are produced. Work revolves on turntable to enable operator to work continuously.

50 YEARS OF SERVICE

KIRK & BLUM

DUST CONTROL

K & B Down Draft Dust Control System in plant of The Monarch Machine Tool Co., Sidney, Ohio

Free Literature

continued

Fasteners

More than 4,000 different fasteners are available as stock items, according to a new brochure now available from The Chicago Screw Company. Standard fastener categories are described and illustrated in the 6-page folder, along with the company's engineering, quality control, and delivery services. Included are a broad variety of socket screw, cap screw, and related fasteners.

The Chicago Screw Co., Bellwood, Ill.

Use postpaid card. Circle No. 12

Precision Grinding Wheels

The friable aluminum oxide abrasive grain being used in the manufacture of SA Borolon grinding wheels is produced in single crystal form without crushing. Thus, it is free of inner stresses and strains.

Each abrasive particle contains multiple cutting edges over its entire surface, permitting greater penetration into the work and faster grinding. SA Borolon is said to have the greatest surface hardness yet achieved with aluminum oxide type abrasives.

Abrasive is proving efficient for use in vitrified bonded grinding wheels for precision work, such as surface grinding and tool and cutter grinding. It is producing grinding wheels claimed to give faster, cooler grinding with longer wheel life and better finishes. Catalog bulletin Form ESA-272 gives complete information.

Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.

Use postpaid card. Circle No. 13

Grinder Millers, Power Quills

General catalog (FGH-3) contains

Use postpaid card. Circle No. 249

Increase Pieces-Per-Belt *30% OR MORE* with MICHIGAN ABRASIVE BELTS

FACTS FROM TYPICAL MICHIGAN ON-THE-JOB FILE:

OPERATION: Backstand grinding-finishing die cast auto-trim parts.

FORMER BELT: Resin bond, 180 grit - 150 pieces per belt.

MICHIGAN BELT: RED COAT Resin bond, 180 grit - 250 pieces per belt.

66⅔% more pieces and nothing was changed but the belt!

Yes, it may be hard to believe but, it's true! And, as you know, nothing puts more value into sales dollars than a major cut in manufacturing costs! More and more people who *thought* they were getting peak production per belt are being amazed at the *additional* production they get from Michigan Abrasive RED COAT Resin belts, discs and sheets.

If you *think* you are getting maximum production and life from your present coated abrasives, you owe it to yourself, for the sake of profits, to test Michigan RED COAT Brand products in your operation. Only then will you *know* if your grinding and finishing costs are at rock bottom.

Michigan Abrasive is the fastest growing manufacturer of coated abrasives in the country . . . and no wonder! The proof is in *performance*. See for yourself what RED COAT, the sharper cutting, cleaner cutting, smoother finishing brand of coated abrasives, can do for you. Call your Michigan representative today or mail coupon for free, complete catalog and representative will call you for appointment. Do it soon. You'll be glad you did!

Michigan®
ABRASIVES

MICHIGAN ABRASIVE CO.

Manufacturers of "The Humidity-Controlled Abrasive"
11911 E. 8-MILE ROAD • DETROIT 5, MICHIGAN

I want to know more about Michigan Abrasives.

Please send free Catalog ☐ Have representative call ☐

Name_____

Title _____

Firm_____

Address_____

City_____ Zone_____ State_____

RED COAT BRAND

Use postpaid card. Circle No. 250

a history and photographs of the Precise Products Corp. and presents the company's grinder millers, power quills, milling machines, milling machine accessories, etc.

The new Super 80 Power Quill is a versatile 1½ hp tool having variable speeds from 7000 to 25,000 rpm. Power flows smoothly without chatter, vibration or slippage from the shaft of the motor to the collet chuck of the quill. No belts to slip and vibrate, or to wear at high speeds, no bulky motor and spindle brackets to adjust.

Precise Products Corp., Racine, Wis.

Use postpaid card. Circle No. 14

All-Purpose Grinding Fixture

Descriptive bulletin presents an all-purpose grinding fixture having a capacity of from 0 to 1½". With it the operator can do index grinding in addition to radial relief and end grinding.

S & D Engineering Co., 2051 W. Mountain St., Glendale, Calif.

Use postpaid card. Circle No. 15

Vibration Analyzers

Two lightweight model vibration analyzers provide portable instrumentation for troubleshooting as well as "in place" balancing of machine tools and plant equipment. The Model 300 is intended primarily for in place and production balancing, while the Model 400 incorporates features for analyzing or troubleshooting as well as balancing.

A bulletin describing the operation and application possibilities of the new units is available from the International Research & Development Corp., 707 Thomas Lane, Columbus, O.

Use postpaid card. Circle No. 16

Petro-Engineering Service

A comprehensive cost-free service provides practical assistance with problems involving fuels, lubricants and other products of petroleum. Highly specialized knowledge and experience is required for application of many types of petroleum products in modern industrial operations. It is essential that these products be chosen and applied with care—and that practical help be provided on such problems as wear, maintenance, storage, dispensing, and application schedules. There have been enormous advances in petroleum science in recent years—particularly in the manufacture and application of lubricants.

The petro-engineering service is backed by 1300 scientists, engineers, metallurgists and chemists who are developing new and improved products to increase production and reduce costs. Research facilities provide background for the company's sales and product application engineers who carry the program to on-the-job sites. Each of these men is a specialist in operation and maintenance of machinery and equipment in a specific industry.

A 24-page illustrated booklet may be obtained from the Gulf Oil Corp., 1822 Gulf Bldg., Pittsburgh 30, Pa.

Use postpaid card. Circle No. 17

Brushes

Recent illustrated publication highlights two power brushes: (1) Osborn Matic Brush, a production brush that maintains precise brushing action under rigorous continuous use. (2) Osborn Tufmatic Brush, designed to do a stronger brushing action than the "Matic," for removing burrs and scale which are difficult for other brushes to handle. Folder shows on-the-job operations, brush specifications and characteristics.

The Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, O.

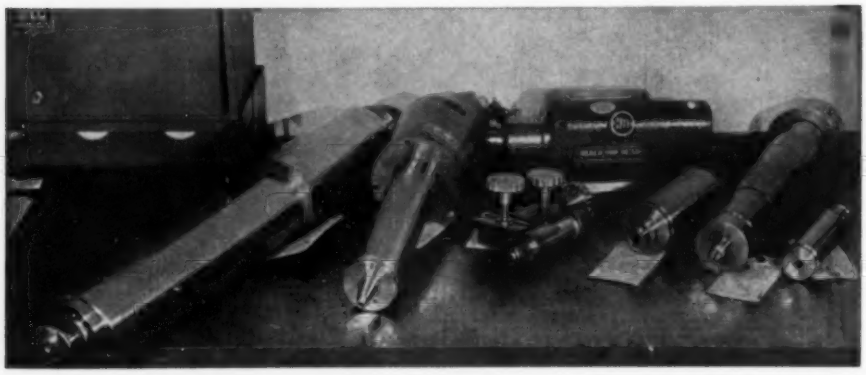
Use postpaid card. Circle No. 18

Industrial Equipment

Handbook contains specifications and descriptive data on full line of office and factory equipment: shelf trucks, lockers, small parts cabinets, hand dryers, blueprint cabinets, display cases.

General Industrial Co., 5736X Elston Ave., Chicago 30, Ill.

Use postpaid card. Circle No. 19



All Makes • Types and Sizes High Speed
Precision Boring and Grinding (including Hi-Cycle Units)

SPINDLES REPAIRED

IN HOURS . . . NOT WEEKS!

Also Anti-Friction Live Centers Restored to Original Accuracy

Air conditioned repair center, trained mechanics and immediate availability of all types of bearings required in these units. We guarantee satisfaction and prompt service!

BEARINGS, INC.

3640 EUCLID AVENUE • CLEVELAND 15, OHIO

Branches in OHIO • INDIANA • PENNSYLVANIA
WEST VIRGINIA • NEW JERSEY • KENTUCKY

Gentlemen:
I'd like to have complete information on your spindle repair service.
Name .....
Firm .....
Address .....
City ..... Zone..... State.....

Use postpaid card. Circle No. 251

Grinding and Finishing

New Equipment and Materials

For further information on any of the products listed here, use the handy postpaid card opposite page 72.

Ball Bearing Wheel Dressers for Cincinnati Centerless Grinders

Aer-O-Matic wheel dressers are now made available for all types of Cincinnati centerless grinders.

According to the manufacturer, finish can now be obtained with the Aer-O-Matic dresser that was heretofore impossible with other types of ball bearing metallic dressers.

The draw bar type dresser holder is for the new LO No. 2 & No. 3 Cincinnati Centerless grinders and the other model shown is for the latest No. 4 and No. 5 centerless grinders and all previous Nos. 2, 3, 4 and 5.

The manufacturer states that 20-25 micro finishes can be obtained with 80 grit wheels; 20-35 micro finishes with 60 grit wheels and finer finishes can be obtained by reducing the grit size of the wheels used, letting the grit size generate the finish desired.

With the Aer-O-Matic dresser, the wheel is opened up and any wheel used will cut more freely, greatly reducing heat and eliminating grinding checks on hardened parts.

When thin wall tubing and parts with keyways and flats are ground, roundness of parts will greatly be improved due to sharper wheels, therefore reducing grinding pressure.

Aer-O-Matic Tool Co., 5059 W. Diversey Ave., Chicago 39, Ill. •

Use postpaid card. Circle No. 101

Aer-O-Matic wheel dressers.

New Tooling for Lapping Aircraft Cylinder Heads

New tooling on the Lapmaster product lapping machine is now available for precision mechanical lapping the flanged faces of radial engine cylinder heads. The tooling was specifically designed to provide an improved method over present hand lapping.

Special combination lapping and conditioning rings which are serrated on both faces replace the standard conditioning rings on the lap plate of the machine. The cylinder heads are then set down into the special rings until the flanged face is in contact with the lapping surface of the ring. When the machine is running, these rings are driven from a gear in the lap plate drive shaft, thereby creating a lapping action on the flanged face since the cylinder is held in a fixed position by a simple holding fixture. At the same time the regular lap plate is truing the under side of the special rings. Thus when the working surface of the ring

New tooling permits lapping two cylinder heads simultaneously.

continued

then doing the lapping on the flange, gets out of flat, they are simply turned over to provide a new completely flat working surface. A flat lapping surface is always available in this lapping procedure to reduce lapping time by about one-third. A balanced lapping procedure permits lapping of two-cylinder heads in the same cycle along with rocker box covers, thrust washers and shaft seals held in a standard conditioning ring.

Crane Packing Co., Dept. GFN, 6400 Oakton St., Morton Grove, Ill. (Chicago Suburb). In Canada: Crane Packing Co., Ltd., Dept. GFN, 617 Parkdale Ave., N. Hamilton, Ont. •

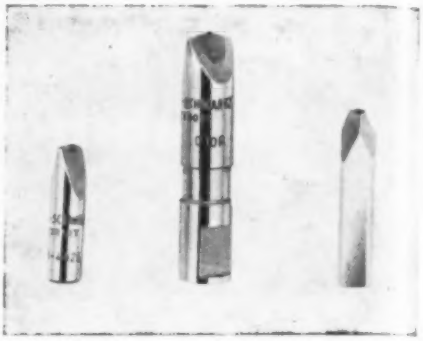
Use postpaid card. Circle No. 102

New Shaped Diamond Tools

A new line of specially processed, shaped diamond dressing tools, designed to permit reproduction of the "pine tree" and other root sections of jet blades and buckets on two-wheel precision form grinders, is announced by Craine-Schwartz Diamond Tool Company.

Illustrated are three types of special jet tools produced by Craine-Schwartz: (1) Jones and Lamson NX-976-1 with .017" radius; (2) Pratt and Whitney Dia-Form with 40° included angle and .010" radius; (3) Ex-Cell-O 48-4428.

Characteristic of these tools is the triangular-shaped macle diamond used. To hold this special diamond securely centered in the tool shank, Craine-Schwartz has developed a new, improved powdered metal matrix material.



Shaped diamond tools for form dressing.

Craine-Schwartz Diamond Tool Co., 8100 Lyndon, Detroit 38, Mich. •

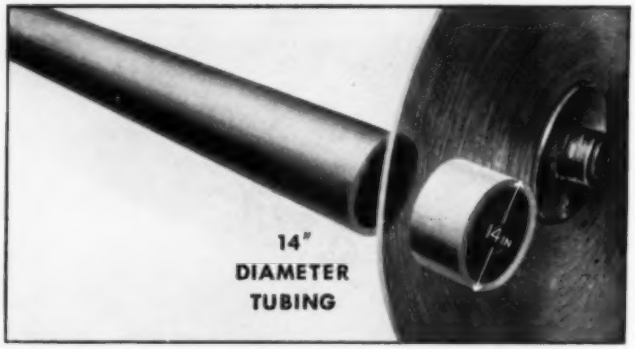
Use postpaid card. Circle No. 103

Allison
Abrasive Cutting Wheels

Abrasive Cutting Know-How

Know-How is just as vital to top performance in abrasive cutting as in any other machine tool operation

BETTER TUBING CUT-OFFS UP TO 14" DIAMETER



• The fastest, lowest-cost, highest-quality cut-offs of almost any tubing material, *in sizes up to 14" diameter*, can be obtained by abrasive cutting...with absolute minimum of burr.

But such performance on your individual tube-cutting job is dependent on your use of the particular type and grade of abrasive wheel that provides the best balance for such inevitable variables as...available equipment...material to be cut ...cutting speed...desired quality of cut...and finally, wheel life.

The full line of Allison Wheels ...rubber or resinoid bonded for wet or dry cut...includes many wheels that are especially designed for Tube Cutting Service.

Allison Field Men...all of them Abrasive Cutting Specialists...have the specialized Know-How, and the wheels, to help you arrive at the best answers to your specific problems. Please ask for their help, without obligation.

Abrasive Cut-Off is the Ideal Method for tubing...tool rooms...job shops...high temperature alloys and tough titanium...heat-sensitive metals...solids up to 12" billets and many other jobs.

***For more complete information** write for this helpful booklet—*
ABRASIVE CUTTING BY ALLISON

Allison Division • AMERICAN CHAIN & CABLE

254-F Island Brook Avenue, Bridgeport 8, Conn.

ACCO

Use postpaid card. Circle No. 252

Reinforced Grinding Wheel

A new concept of flared cup wheel construction, offering great initial strength and safety for the operator, has been announced by the Manhattan Rubber Division, Raybestos-Manhattan, Inc.

The manufacturer states the new design, known as Safety Back, far surpasses ordinary safety features offered by anchor bushings, safety rings, special hub mountings, and revolving cup guards. This Safety Back feature puts the prevention of accidents where it is needed most—in original strength and breakage resistance. Steel covers the entire back, and extends down the side to add more reinforcement. Patents have been applied for.

The Safety Back materially aids in overcoming abusive wheel mounting and operating practices connected with the use of flared cups. The steel backed threaded steel insert provides convenient and secure mounting, while eliminating all possibility of the hub being pulled out.

Ease of operation is also featured. The Safety Back covers no more of the wheel than a revolving cup guard, so it cannot interfere with the operator's maneuvering, and doesn't require constant adjustment, as do skirt guards. The Safety Back is disposable, and no premium price is asked for this improved design. Bulletin No. 7157.

Abrasive Wheel Dept., Manhattan Rubber Div., Passaic, N.J. •

Use postpaid card. Circle No. 104

Metal removal *faster* at lower cost

CHICAGO MOUNTED WHEELS

Prompt Out-of-Stock Deliveries

There is a precision-engineered Chicago Mounted Wheel or point for every imaginable grinding operation. Ideal for efficient, effective deburring. . . . Always available . . . in all standard sizes, and over 200 special shapes, for out-of-stock delivery. Save Time – Money – Materials . . . Specify Chicago Mounted Wheels!

Every Chicago Mounted Wheel is produced under positive production control . . . assuring perfect uniformity of mounted wheels and points. There is no variation from one production run to another.

Positive density control for peak job performance

Guaranteed to stay on the mandrel . . . perfectly balanced

Chicago Mounted Wheels are easily dressed and hold their shape

Unlimited number of combinations of dimension, shape, grain, size and bond

WRITE FOR *Trial* CHICAGO WHEELS

Test them yourself!

Send coupon for two Chicago Mounted Wheels . . . Test one against the other . . . you'll see the meaning of true uniform performance!

CHICAGO WHEEL & MFG. CO. G
1101 W. Monroe Street • Chicago, Illinois

Send me two sample Chicago Mounted Wheels without charge:

Name .....

Address .....

City ..... Zone ..... State .....

Use postpaid card. Circle No. 253

continued

3M Introduces Rubber Contact Wheel

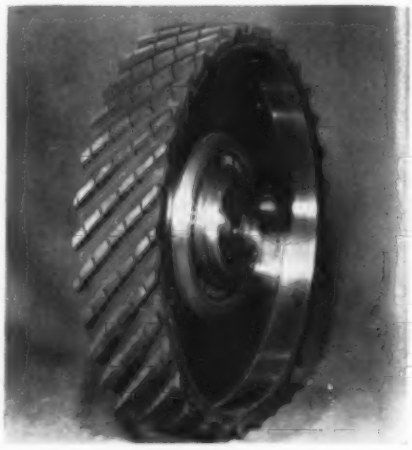
A new rubber contact wheel has been developed by Minnesota Mining and Manufacturing Co., St. Paul, Minn., for use on backstand grinding and polishing operations.

Made with a slashed serration, the "X" wheel is formed from a new type of neoprene that is substantially more abrasive resistant than rubber compounds previously used in contact wheel manufacture, according to the 3M company. An improved type of flange construction eliminates the possibility of misseating the flange because it is an integral part of the wheel, and is permanently attached to the hub.

Because of the new type of serration, the wheel has wider-than-usual lands providing more rubber surface for longer wear, but with no sacrifice of conformability or aggressiveness. The wheel has, in fact, more conformability than wheels with standard serrations, and leaves no mark on the work piece.

The new contact wheel is finding application in off-hand weld removal, grinding and polishing of gates and parting lines, snagging and finishing on fabricated metal parts.

The "X" wheel is available in a 14" diameter with 1", 2", 3" and 4" face widths, and in several durometers. It is believed, however, that 80, 55, 35 and 20 durometers will be suitable for most



applications. To facilitate the selection of wheels for a given job, harder durometer wheels are colored red, and the softer durometer wheels are silver-gray.

The "X" wheel is made by, and is available from, the Chicago Rubber Company, 651 Market Street, Waukegan, Ill. •

Use postpaid card. Circle No. 105

Degussit Honing Stones

Lovejoy Tool Company, Inc., Springfield, Vermont announces its appointment as distributor in U.S.A. for Degussit Honing Stones.

These honing stones are bond-free polycrystalline ruby, sintered at high temperature. They are available in a wide variety of sizes and shapes, including mounted wheels, to suit all kinds of tool, die and instrument work. They are equally effective for honing HSS or tungsten carbide. The photograph illustrates a salesman's display kit that contains one each of the Degussit line of standard Honing Stones and Wheels.

Available through all Lovejoy Distributors.

Use postpaid card. Circle No. 106

Honing stones.

For increased production . . .

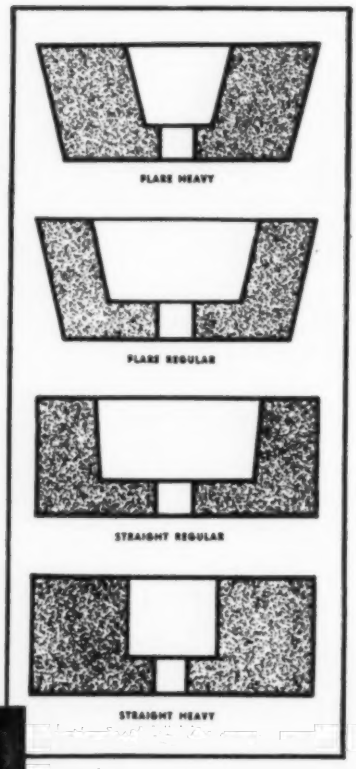
ATLANTIC

"Job-Mated"

GRINDING WHEELS

A manufacturer of marine propellers raised finishing output 15% with the use of ATLANTIC "Job-Mated" GRINDING WHEELS. Closely-mated wheel characteristics with job requirements were credited as the main factors in making this increase possible. ATLANTIC representatives work on the basis that every grinding operation should be engineered for best results.

ATLANTIC Resinoid-Bonded CUP WHEELS are available in all popular shapes, sizes, grits and grades. Their wider lip design increases wheel life without sacrificing fast cutting qualities. Investigate their production possibilities. Consult your ATLANTIC ABRASIVE representative, or write direct to ATLANTIC ABRASIVE CORPORATION, 532 Pearl St., South Braintree 85, Mass.

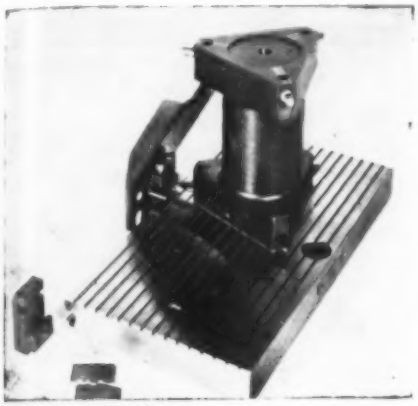


For maximum safety, all ATLANTIC CUP WHEELS from 2½" up are speed-tested at a 50% higher speed than normally required.

ATLANTIC ABRASIVE CORP.

South Braintree 85, Massachusetts

Use postpaid card. Circle No. 254



Dresser unit alone.

Form Dresser

The Contour'Rex is a compact form dresser which forms grinding wheels with a one-to-one template ratio. It can be fitted permanently or temporarily to most types of standard grinders.

The Contour'Rex is said to cancel out fully the loss in precision caused by rapid wear of the diamond point. With normal care and skill of operation, it is claimed to reproduce the template form within .0002-in. at all points of the form.

The Contour'Rex consists of two basic units—the dresser and tracer unit, and a "rectifier" unit which corrects errors occurring in the dresser unit from wear of the diamond. The rectifier is said to be the "secret" of the accuracy of the dresser, combining a checking and truing of the tracer-diamond relationship.

The templates are one-to-one with the form to be dressed and can be made on common shop tools using commonly available materials such as worn out power hacksaw blades. Diemakers can use either punch or die sections as templates for the mating part. The unit permits any amount of clearance between punch and die.

Price of the Rectifier unit is $650.00, while the basic dresser is $230.00. One rectifier can be used in conjunction with several dresser units.

Form-All Mfg. Co., 364 Glenwood Ave., East Orange, N.J. •

Use postpaid card. Circle No. 107

Rectifier unit.

If you are...

the purchasing agent

or stockkeeper

or production superintendent

or tool supervisor

Send for this catalog

At a glance you can find the wheel to do the job, and get fast delivery.

IT'S THE MOST!

LIFE WILL BE SWEETER!

Write to or phone:

SIMONDS WORDEN WHITE COMPANY

1101 Negley Place, Dayton 7, Ohio—RA-2106

Use postpaid card. Circle No. 255

continued

Micromatic "150" Honing Machine

A new Microhoning machine, providing both versatility and economical automation, is being produced by Micromatic Hone Corporation. The new machine, designated the Micromatic "150," is of standardized, compact design. Its price is within the range of a manufacturer with limited capital or of one with low production requirements. It is available for immediate delivery as a stock item.

The Micromatic "150" is designed to fill the gap between the large mass producer and the small shop. Knowledge and experience gained during years of producing large, highly automated honing machines were applied to the design of this smaller model.

Initial design step was to break down the functions of larger machines into the four steps necessary for full automation. These steps are: (1) Automatic stroking, (2) Automatic feed control and stone wear compensation, (3) Automatic sizing and (4) Automatic work handling. It was decided that an

ideal design for this basic Microhoning machine would incorporate along with its standard equipment only one of the automatic functions—automatic stroking, with stroking controls. Additional equipment listed in Table "C" is offered as optional equipment which can be added whenever desired.

Built as a horizontal type machine with a stationary bridge to accommodate work fixtures and optional equipment, design facilitates addition of automatic work handling devices and simplifies changeovers from one job setup to another. The spindle is mounted on a reciprocating carriage, hydraulically actuated, while the adjusting head is manually operated. The machine base is cast in one piece.

The machine has a 12″ stroke and 1½″ work diameter capacity. Because of the standard basic design, special engineering is limited to fixturing and tooling.

The economical initial investment required for this basic machine is said to bring it within the reach of smaller manufacturers with limited capital as well as making it practical for larger producers who have short production runs or a need for standby equipment. It can be partially or fully automated by addition of standard "package units." The purchaser begins with the standard, basic machine. At a later date he can add the automatic feed "package," which includes an automatic stone wear indicator and compensator; the automatic sizing "package," either

LEA GRIPMASTER®

Industry's Abrasive
BONDING CEMENT
for Wheels and Belts

GREATER FLEXIBILITY
— Finer Breaks

Isn't that what you want in a wheel or belt . . . a condition that permits the abrasive grains to get into crevices and go around curved surfaces? A test of Gripmaster under your working conditions will prove it superior from this angle. Send for a generous size free sample, enough to let you make a convincing competitive test.

LEA-MICHIGAN, INC.
14066 Stansbury Ave., Detroit 27, Michigan
(A member of the well-known Lea Group of Finishing Specialists)

Lea-Michigan, Inc.
14066 Stansbury Ave.
Detroit 27, Mich.

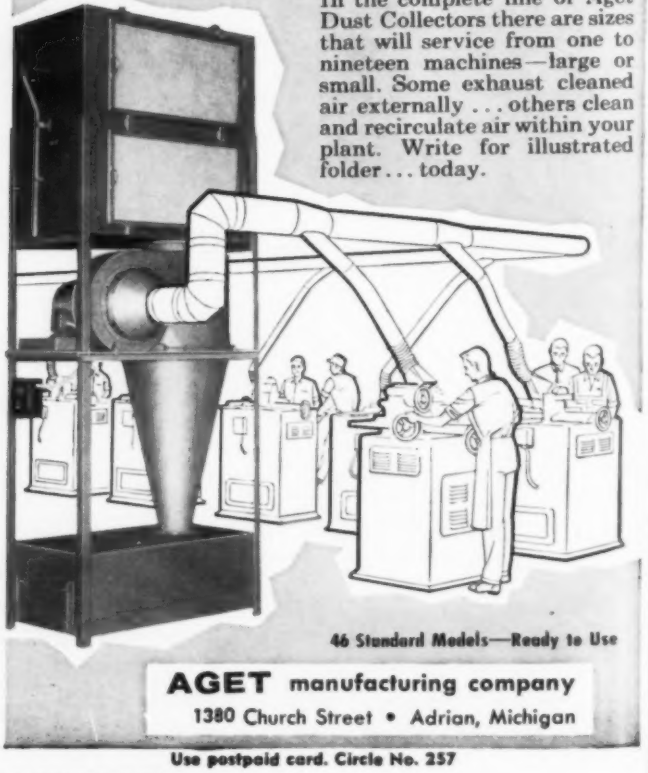
☐ Please send us your free sample of GRIPMASTER.
☐ Please send us literature giving full details.

Name_____ Title_____
Company_____
Address_____ GF.4-57

Use postpaid card. Circle No. 256

just ONE DUSTKOP STOPS DUST
heavy duty unit services up to 19 MACHINES

In the complete line of Aget Dust Collectors there are sizes that will service from one to nineteen machines—large or small. Some exhaust cleaned air externally . . . others clean and recirculate air within your plant. Write for illustrated folder . . . today.



46 Standard Models—Ready to Use

AGET manufacturing company
1380 Church Street • Adrian, Michigan

Use postpaid card. Circle No. 257

gage plug or gage ring type; or automatic work handling as the step which brings the "150" to full automation. Horizontal construction simplifies addition of a wide variety of automatic work handling devices.

SPECIFICATIONS, MICROMATIC "150":

Maximum Stroke: 12"
Work Capacity, Diameter: Up to 1½"
Overall H x W x L: 58" x 34" x 52"
Height, C/L Spindle to Floor: 44"
Height, C/L Spindle to Table: 5"
Table W x L: 17" x 16"
Hydraulic Oil Capacity: 20 Gallons
Spindle Rotation Speed: Variable speed drive
Reciprocation Speed Range: 0—60 S.F.-P.M.
Approximate Weight: 3500 Lbs.

OPTIONAL EQUIPMENT:

Microdial automatic hydraulic feed and stonewear compensation
Automatic stonewear indicator and controls (used with Microdial)
Automatic coolant separator, pump and tank
Automatic sizing (Gage Plug or Gage Ring Microsize) control to suit application)

Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich. •

Use postpaid card. Circle No. 108

Stanley Introduces 8-Inch Grinder

A new heavy-duty 8-inch grinder featuring extended frame construction has been introduced by Stanley Electric Tools.

Extra distance between 8-inch grinding wheels and their greater diameter than the motor housing make it easier to grind large odd-shaped pieces. Motor is ¾ h.p., capacitor start and induction run.

The safety wheel guards on the No. 288 are drilled for Stanley eye-shields and have exhaust outlets and spark shields. Tool rests are fully adjustable for all-position grinding on wheel circumferences. The grinder comes equipped with cord, rubber feet, and one coarse and one fine grain wheel.

Stanley Electric Tools, division of The Stanley Works, New Britain, Conn. •

Use postpaid card. Circle No. 109

Stanley 288 heavy-duty grinder.

New Brush-Back Head

A design change in the Vonnegut brush back polishing head has opened up new fields of application for mechanical methods, announces the Grinding & Polishing Machinery Corporation.

Design change involves building heads in one-inch widths and furnishing long-trim bristle brushes (as standard equipment) when specified.

The new one-inch width Vonnegut head, with long-trim bristles (backed by your choice of grade and grit of abrasive loading) permits flash removal, for instance, from steering wheels as illustrated.

The Vonnegut head is desirable for contour surfaces or on intricate designs in metal, wood, rubber, plastics or other materials. The new head fits shorter spindles and allows more maneuverability.

Grinding and Polishing Machinery Corp., 2530 Winthrop Ave., Indianapolis, Ind. •

Use postpaid card. Circle No. 110

Hammond OF KALAMAZOO
GOOD MACHINERY SINCE '82

MODERN Self Contained GRINDER-POLISHER

Hammond Variable Speed (1500 to 3000 RPM) Polishing and Buffing Lathe. Models up to 50 HP available.

Hammond Cyclone Duskolector. One of a wide line of Cyclone and Filter Types.

Hammond Backstands. 10 Air and Spring Tension Models to choose from.

Write for Catalog No. 60 showing America's most modern and complete line.

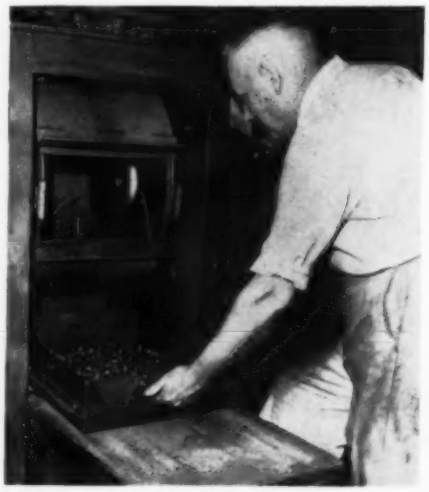
Hammond Machinery Builders INC
1651 DOUGLAS AVENUE • KALAMAZOO, MICHIGAN

Use postpaid card. Circle No. 258

continued

Plastisol Lining Increases Barrel Life

Lining blast barrels with plastisol has increased barrel life from 3 or 4 months to more than three years at the Underwood Corporation's Hartford, Connecticut plant. A barrel revolves around a blast nozzle for finishing small typewriter parts. Unlined barrels wore quickly under the blast and cost $35.00 to replace.



To reduce the cost of replacements and eliminate the inconvenience of changing barrels frequently, Underwood had all barrels spray-coated with Unichrome 5300, a plastisol made by Metal & Thermit Corporation. This coating is abrasive and chemically resistant. Underwood also uses a similar coating for coating racks and tanks in its plating department.

The plastisol lined barrels have stood up in constant use under the sand blast for three years. Since a barrel can be relined, it need not be replaced even after the lining wears out.

Cost of the plastisol lining was $58.00. Underwood calculates that savings for the three year period total about $385.00 per barrel. •

Use postpaid card. Circle No. 111

Gage Blocks

Shop-Blocks—lowest priced gage blocks of "A" grade quality are being announced by The DoAll Company. The new Shop-Blocks are designed for everyday shop measurement applications.

In 1956 DoAll discontinued the manufacture of "B" grade gage blocks as being insufficiently accurate for modern dimensional control. Shop-Blocks are manufactured to the National Bureau of Standards specifications for "A" grade gage blocks but they are less expensive than "B" grade working blocks offered by others. Shop-Blocks are accurate to +.000006" and —.000002" from the actual size engraved on each gage block. Flatness and parallelism of each Shop-Block is held within .000004". Surface finish is .8" AA (Arithmetical Average).

Set No. 860 priced at $265.00 contains 84 blocks varying in size from .050" to 4" and will produce any dimension .200" to over 20" in increments of .000025".

Shop-Block Set No. 380 priced at $130.00 contains 36 blocks and will produce any dimension between .300" to over 8" in increments of .000050".

Wear blocks are available for either set in sizes of .050" or .100" and in tungsten carbide or steel.

The DoAll Company, Des Plaines, Ill. •

Use postpaid card. Circle No. 112

Production Grind - Tungsten Carbide - Steel - Stainless Glass - Plastic or Carbon to .0002 or 6 to 8 Micro finish *

on the ROYAL MASTER TG-12 Centerless Grinder

Apply the versatile Royal Master TG-12 to your grinding problem.

It will finish grind from .004 to 1½ inches in diameter.

It may be used for either plunge or thrufeed grinding with conversion to either a matter of minutes.

It may be put to work **without** prior spindle warm up time with unparalleled accuracy and dependability - (Based on machines in use for 5 years.)

Low depreciation based on initial cost - Ease and speed of set up time due to accessibility of work zone - Rapid replacement of work wheel and packaged hydraulic system for automatic cycling, are other features of the TG-12. What are your requirements?

May we demonstrate the TG-12 for you on your parts?

* Also Grinds Wood, Non-ferrous Metals, Fibre, Hard Rubber, Cork, etc.

☐ Please contact me regarding my "centerless grinding" requirements.

☐ Please forward literature describing the TG-12.

PERS. ..... TITLE .....

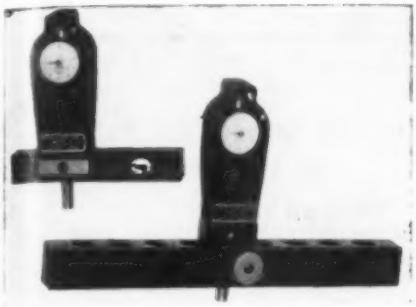
FIRM .....

STREET .....

CITY ..... STATE .....

ROYAL MASTER INC.—200 STATE HWY. 23, RIVERDALE, N. J.

Use postpaid card. Circle No. 259



Indicator Depth Gages

It is now possible to select a completely standard indicator depth gage for practically any part condition by utilizing a standard series of interchangeable gage components being marketed by the A. G. Davis Gage & Engineering Company. By selective variation of components, over 3500 standard depth gages may be specified to gage special dimensions. No alterations of standard components is required. Complete depth gages may be ordered by combining the selected component model numbers, eliminating the necessity of design drawings in most cases. All standard models may be easily set to either gage blocks or a master set gage. Any of the popular makes of indicators may be furnished with the gage.

A. G. Davis Gage & Engineering Co., 21435 Dequindre Rd., Hazel Park, Mich. •

Use postpaid card. Circle No. 113

RUBBER CONTACT WHEELS have newly designed tire-flanged total disc assembly on steel, reducing use of costly aluminum hubs. Assembly made of cold-rolled, drawing quality steel, with welded construction. Wheels are available in many sizes in plain or serrated faces in all hardnesses for use with all types of abrasive belts. Designed for use in a wide variety of finishing operations, the wheels are made of oil resistant rubber and produce longer belt life. Wheels have 30% trade-in value when worn. Chicago Rubber Company, 651 Market St., Waukegan, Illinois.

Use postpaid card. Circle No. 114

Positive Lock Wedge

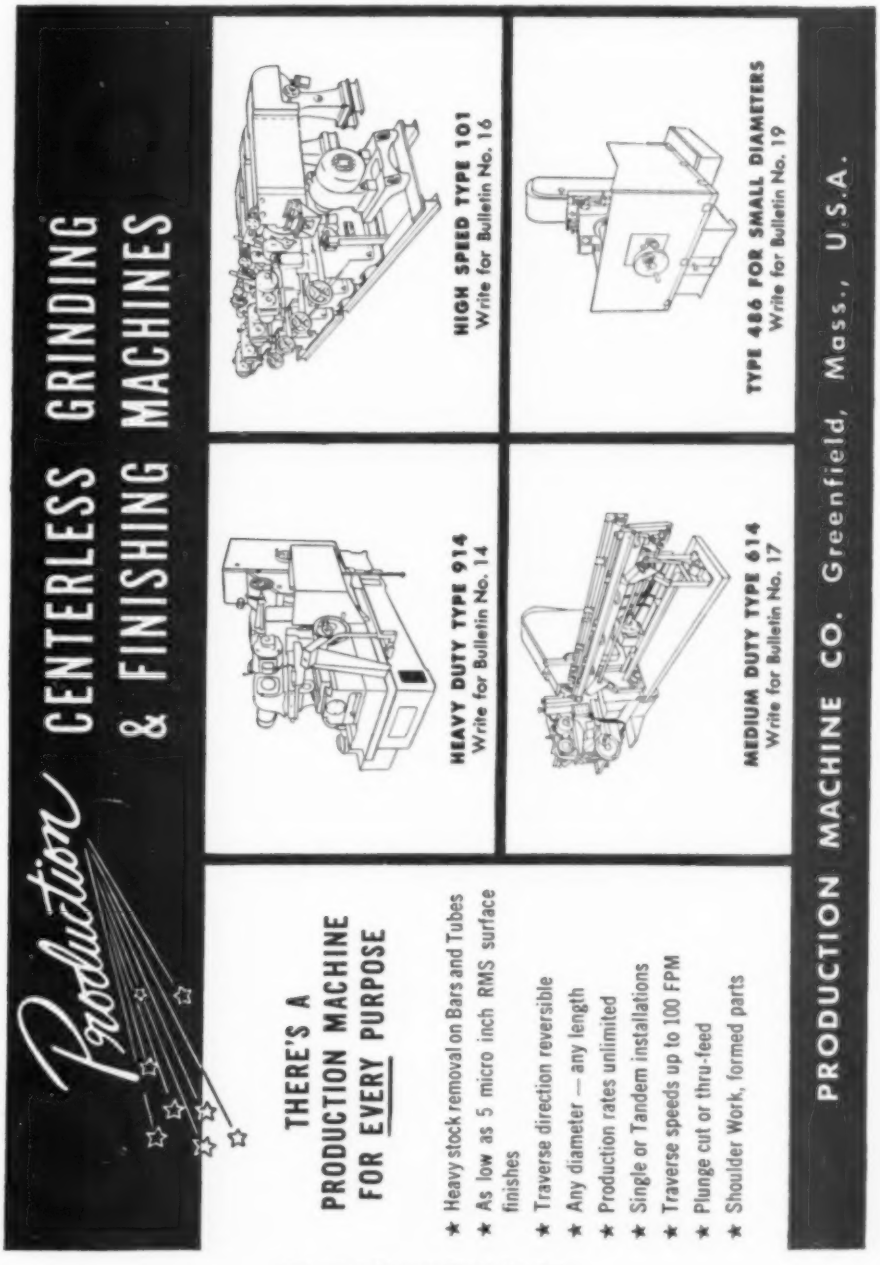
Futurmill, Inc., announces the new Vise-Lok wedge, a positive locking wedge that can be tightened or released with an Allen type wrench. It turns in for wedging and positive locking . . . turns out for easy tool indexing or removal. Damage to tools or fixtures due to hammering or pounding the wedges is eliminated.

The Vise-Lok wedge can be used in tool holders, milling cutters, lathe tools, clamping devices, jigs and fixtures—in fact in any tool assembly requiring a wedging principle. It is manufactured in standard sizes from ⅜" to ¾" O.D. and ⅜" to 1½" in lengths. Special diameters and lengths are available.

Futurmill, Inc., 6360 Highland Rd., Pontiac, Mich. •

Use postpaid card. Circle No. 115

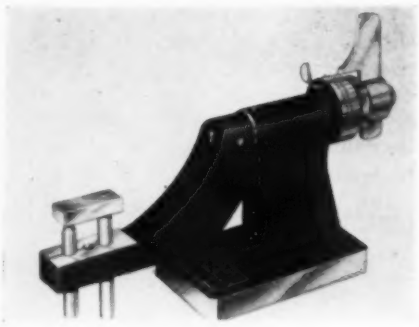
Futurmill Vise-Lok wedge.


Production CENTERLESS GRINDING & FINISHING MACHINES
HIGH SPEED TYPE 101
Write for Bulletin No. 16
TYPE 486 FOR SMALL DIAMETERS
Write for Bulletin No. 19
HEAVY DUTY TYPE 914
Write for Bulletin No. 14
MEDIUM DUTY TYPE 614
Write for Bulletin No. 17
THERE'S A PRODUCTION MACHINE FOR EVERY PURPOSE
★ Heavy stock removal on Bars and Tubes
★ As low as 5 micro inch RMS surface finishes
★ Traverse direction reversible
★ Any diameter — any length
★ Production rates unlimited
★ Single or Tandem installations
★ Traverse speeds up to 100 FPM
★ Plunge cut or thru-feed
★ Shoulder Work, formed parts
PRODUCTION MACHINE CO. Greenfield, Mass., U.S.A.

Use postpaid card. Circle No. 260

Radius Dresser

A new radius dressing tool is currently being introduced by the Rothfuss Tool Co. Called the Rothfuss G-5 radius dresser, it is precision engineered to enable even the unskilled workman to dress either a convex or a concave radius from .015″ to 1.750″ on any grinding wheel up to 10″ in diameter at lowest cost. The Rothfuss G-5 has graduated stops that allow the operator to dress any portion of a wheel's radius that he might desire. A major feature incorporated in this new unit is its spring tension journal that insures chatter-free operation. This new low cost unit has a chrome black crinkle finish. Priced at only $80.00 including the cutting diamond.



Rothfuss G-5 Radius Dresser.

Rothfuss Tool Co., Box 2804, Providence 7, R. I. •

Use postpaid card. Circle No. 116

ID Tank Grinder and Polisher

For polishing the inside diameters of open end cylindrical tanks, as used in the dairy, chemical and food processing industries, the Hi-Lite company has designed an ID Tank Grinder and Polisher which produces a uniform longitudinal scratch pattern. The machine is designed for tanks ranging from 33″ to 20′ in diameter, and up to 12′ long, and utilizes a 6″ x 148″ coated abrasive belt.

The abrasive belt is mounted on a traversing grinding head which lifts from the work at the end of each pass, allowing the tank to be rotated. The amount of overlap of each successive belt pass can be closely controlled, and the rate of carriage travel is variable. All controls are centralized on a master panel.

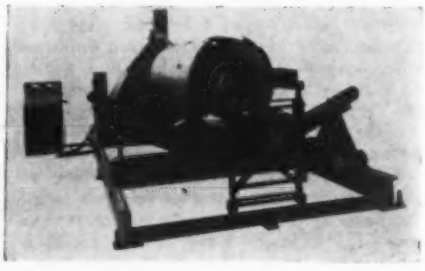
The ID Tank Grinder and Polisher is approximately 8′ wide by 22′ long, and has a belt speed of 6500 s.f.p.m. with a traverse speed of up to 20 f.p.m. The abrasive belt is lubricated with an automatic oil spray device to lengthen belt life and produce a uniform finish.

A companion machine to the ID grinder is the Hi-Lite Tank Head Grinder and Polisher, which operates on the basic principle of a swing grinder. The unit is designed so that the operator has full vision of the point of contact. The machine utilizes a 1″, 1½″ or 2″ coated abrasive belt running over a serrated rubber contact wheel, with a belt speed of 6500 s.f.p.m.

The head grinder can be used on either the inside or outside of pressed or spun stainless steel tank heads, which are held by either mechanical or vacuum clamping methods. The standard model head grinder will accommodate tank heads up to 6′ in diameter.

Hi-Lite Polishing Machine Co., Dept. F7-49, Route 2, Sheboygan, Wis. Coated Abrasive belt information will be supplied by the 3M Company, Dept. F7-49, 900 Fauquier Street, St. Paul, 6, Minn. •

Use postpaid card. Circle No. 117



ID tank grinder and polisher.

No. 4 *"Roughing it"* with Reddy MacFlint

Worth a fishing invitation? In sanding and polishing circular metal pieces with aluminum oxide cloth, the grain coating was weakened and the sheets left limp by many folds. A solution involving JEWEL BRAND ABRASIVES *cut costs 15%.*

"Smoothing the way where the going is rough"

AP salesmen know that there is a *certain flexibility* in coated abrasives that will work best on most operations. To determine it properly will result in better work at lowest cost.

Abrasive Products, Inc.

South Braintree 85, Mass.

MAKERS OF JEWEL COATED ABRASIVES

Use postpaid card. Circle No. 261

Concentricity Gage

A magnetically-attached concentricity gage has been introduced by Clark Engineering and Manufacturing Company, of Racine, Wis.

The precision unit can be used on drill presses, boring tools and lathes; in toolrooms, inspection and production operations. A very exact lateral adjustment mechanism for the indicator is mounted in a permanently magnetized holder. Made of the finest quality materials, the gage provides quick, easy, accurate set up for checking concentricity of shafts.

The Clark Concentricity Gage sells for $97.50.

Clark Engineering and Manufacturing Co., 1820 Layard Ave., Racine, Wis. •

Use postpaid card. Circle No. 118

Concentricity gage is magnetically attached.

Finishing Buff

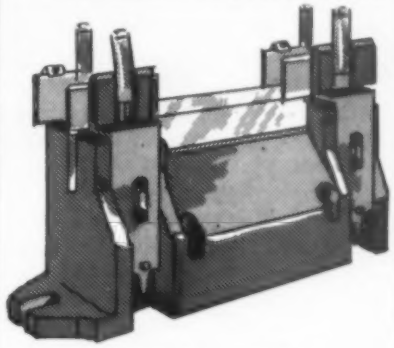
A new 7½" finishing buff for high luster polishing has been announced by The Schlegel Manufacturing Company. Made of wool pile with a heavy duck backing, the Amcor No. 7 Beauty Buff offers high quality and performance at an economy price for finishing painted or plated surfaces.

Said to be ideal for the toughest polishing operations of industrial polishing departments, automotive fleet owners, furniture manufacturers, job shops, automotive assemblies, or homes, the Beauty Buff pad adapts evenly to irregular surfaces and is recommended for aluminum, brass, silver, soft metal alloys as well as for chrome and painted surfaces.

The Schlegel Mfg. Co., Rochester, N. Y.

Use postpaid card. Circle No. 119

NEW GLOBE THRUFEED WORK REST



DELIVERY from STOCK!
FOR NO. 2 CINCINNATI CENTERLESS GRINDER

6" THRUFEED (Without work blades) $260.00

8" THRUFEED (Without work blades) $265.00

(above F.O.B. Detroit)

Dealer Inquiries Invited

GLOBE TRADING COMPANY
1815 Franklin St., Detroit 7, Mich.
Phone WOodward 1-8277

Use postpaid card. Circle No. 262

for CARBIDE GRINDING use
PRECISION'S LO-TENS vitrified wheels

Because — for more than 10 years Precision has maintained its supremacy in the field of roughing and semi-finishing carbide tools of all types.

Because — competition and extravagant claims have challenged us constantly, but we're still "Tops."

Because — generally a green (DC) wheel in Precision's improved 15 or 15F open structure will do your carbide grinding better, quicker, cooler, and more economically.

Prove it yourself!

grinding the PRECISION way makes precision grinding pay

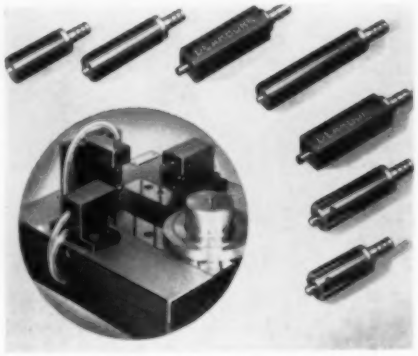
PRECISION
GRINDING WHEEL COMPANY
PHILADELPHIA 36, PENNSYLVANIA

Use postpaid card. Circle No. 263

Standard Air-Gage Cartridges

Stock delivery from a complete line of multiple-amplification contact air gage cartridges for interchangeable use on any make or type of air gage instrument is announced by the Air Gage Division, Dearborn Gage Co.

Guaranteed for accuracy and linearity, these cartridges are used in checking hard-to-reach surfaces and relationship dimensions involving outside diameters, inside diameters, steps eccentricity, concentricity, flatness, parallelism and similar gaging applications. Their interchangeable use through multiple-amplification ranges eliminates the need for using a specific cartridge for a specific tolerance range, and reduces the size of the inventory required with ordinary, single-amplification cartridges, according to the manufacturer.



Dearborn standard gage cartridges.

The new line includes normal, short normal and reverse cartridges which can be used interchangeably for 15-hundred, 3-thousand and 6-thousand-to-one amplification ranges. In addition, a long range, low-amplification cartridge for 15-, 30- and 60-thousand-to-1 amplifications ranges, plus a square body type cartridge for simple fixturing applications, are also offered as standard items.

All Dearbornaire contact type air gage cartridges are equipped with tungsten carbide gaging tips for increased wear life, and the cylindrical styles are optionally available with external threads for easier, finer adjustment and simplified setting.

Dearborn Gage Co., 22038 Beech St., Dearborn 8, Mich. •

Use postpaid card. Circle No. 120

FOR *High Speed* CUTTING
TO AMAZING TOLERANCES
. . . The TY-SA-MAN 122-C

IF YOU CUT . . .

ALUMINUM
MAGNESIUM
TITANIUM
STEEL
IRON
COPPER
GRATING
PLATE
STRUCTURALS
STAINLESS STEEL

There's a Ty-Sa-Man Saw to Meet Your Needs

Cut Your Inventory By Cutting Your Own Metal

Stock big sizes and cut it as you need it . . . that's the success story behind the Ty-Sa-Man saws that are paying big dividends to warehouses, fabricators and manufacturers from coast to coast. Best of all, when you cut it, in most cases, it's ready to use. The clean, square, accurate edges produced by this production saw need little or no machining or finishing work. This adds up to a saving of thousands of man hours, and just as important, saves the loss of waste metal.

Write For Free Catalog

Ty-Sa-Man MACHINE COMPANY

1016 WHITE AVENUE, KNOXVILLE, TENNESSEE

Use postpaid card. Circle No. 264

Safety Spectacle

New S-7 Square Shape plastic safety frames in bronze or crystal pink are good looking, lightweight and unusually comfortable, according to the manufacturer. Safety lenses in Optilite (lightweight plastic safety lenses), and hardened glass are available in plano or to any prescription to correct vision. Standard shades of green and rose tint safety lens are also available. Two temple types, plastic spatula, and the riding bow cable come in a choice of lengths. Four eye-sizes and five bridge-sizes and adjustable or fixed nose pads, make it easy to properly fit all employees.

The entire safety spectacle meets Federal specifications. S-7 Spectacles are available to industry direct from the manufacturer, the United States Safety Service Company. For full information and Rx forms, write 1215 McGee St., Kansas City 6, Mo.

Use postpaid card. Circle No. 121

New York manufacturer of complete line of diamond tools and wheels still has some territories available for a live wire representative.

BOX GF10, GRINDING & FINISHING
222 E. Willow Ave., Wheaton, Ill.

Optical Profile Grinding Machine

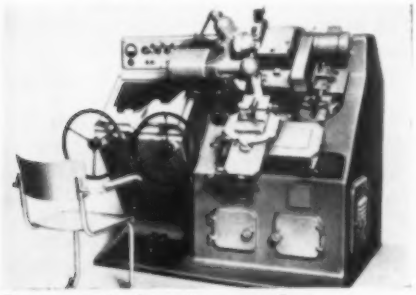
A product of West Germany, the new Petewe P F S 4u, encompasses the latest design in optical profile grinding machines, developed by German optical craftsmen.

The unit is available with magnification of 10x, 20x, 50x, 100x, and handles a maximum workpiece thickness of 3.15".

By using the episcopic and the diascopic light for the projection, it is possible to grind all types of forms by flat form grinding, relief form grinding, axial circular form grinding and radial circular form grinding with an accuracy of plus/minus .00008" at 100x magnification.

U.S. Agent: Carl Hirschmann Co., Inc., 30 Park Ave., Manhasset, L. I., N. Y. •

Use postpaid card. Circle No. 122



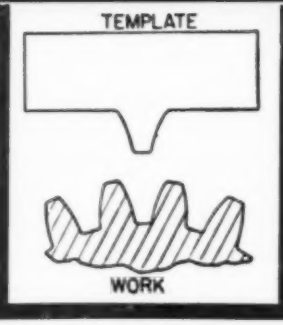
Petewe optical contour grinder.

ADJUSTABLE I.D. AND O.D. GAGE— Designed primarily for inspecting bearing assemblies, this Precisionaire pneumatic gage can be used on other applications where an adjustable I.D. and O.D. check is desired. Interchangeable spindles and backstops are used for different bore sizes while the outside diameter check is adjustable through the 2" size range. This particular gage was supplied with 14 sets of tooling, each set consisting of a different size spindle and corresponding minimum and maximum setting rings. Standard Production Instruments, Div. No. 610, The Sheffield Corporation, Dayton 1, Ohio, U.S.A.

Use postpaid card. Circle No. 123

the Contour Rex RECTIFIER

NEW WAY TO PRECISION-FORM GRINDING WHEELS USING ONE TO ONE TEMPLATES and TOTALLY NEW RECTIFIER TO CORRECT TRACER FOR WEAR OF DIAMOND



Rectifier, $650.00

- Combines checking and trueing of tracer and diamond relationship.
- Tracer rectified by half-rotating motion of diamond head. Tracer ground against small grinding wheel directly below.
- Checking done with similar motion on side of indicated square preset to split .0005".
- Master square and holder for checkers included.
- One rectifier used for several dressers.

Dressing unit, $230.00

- Combines platen and diamond head. 3 diamonds and 3 tracers. Diamonds not included.
- Form dresses **hard** as well as soft wheels without removing work from grinder.
- Smallest inside radii and fillets limited only by point of diamond.
- Prices subject to change.

FORM-ALL MANUFACTURING CO.

Providing: "The Engineering Service for ALL Form Grinding"

364 Glenwood Avenue **East Orange 3, New Jersey**

Use postpaid card. Circle No. 265

PRESSURE-LOK® 224

RESINOID DIAMOND WHEELS

— the best diamond wheel bond ever developed —

if you've used them - you know they're best!

if you haven't - let us show you!

UNITED STATES DIAMOND WHEEL CO. AURORA, ILL.

Use postpaid card. Circle No. 266

continued

New Fluid for Magnetic-Particle Inspection

A new low cost material for Magnaflux-type magnetic particle inspection of metal to detect flaws has recently been developed by Harry Miller Corp. The new product called Immunol 438, replaces kerosene and mineral spirits, gives a better definition of flaw and prevents rusting of the metal. In addition, the product eliminates the fire hazard since it is nonflammable, is odorless for better operator acceptance and it is self-cleaning. Immunol 438 is said to be particularly economical since one drum replaces many drums of solvent. The specified mixture is one part Immunol 438 to seventeen parts water and this mixture suspends uniformly either fluorescent or nonfluorescent paste.

Harry Miller Corp., 4th & Bristol Sts., Philadelphia 40, Pa. •

Use postpaid card. Circle No. 124

Convex Radius Grinder

Nassau Convex Radius Grinder can grind either the right or left side of a milling cutter or single point tool to a 90 degree radius, and it can also grind a 180 degree radius in a single set-up.

Form dressing of the wheel is eliminated. Total set-up and machining time (including rough-&-finish grinding) for the average milling cutter is less than one hour.

Nassau Convex Radius Grinder.

Cutters up to 6 inches in diameter, and from practically zero to 2 inches thickness can be ground on this machine. •

Use postpaid card. Circle No. 125

Engelberg Announces Color Film on Multiple-Head Abrasive Belt Grinders

Entitled "Two Heads Are Better Than One", a new 16mm. 18-minute color film with narration features the No. 680 series of multiple-head, conveyor-type abrasive belt grinders manufactured by Engelberg Huller Company. The film shows action sequences of various machines in production on ferrous, non-ferrous, plastic and other materials. The No. 680 series, with from two to six grinding heads and conveyorized through-feed, permits multiple grinding operations in the same time as formerly required for a single operation, with no added labor requirements.

A four-head model, using a series of progressively finer-grit belts, is shown surfacing chain saw bars in a single automatic grinding sequence. A two-side adaptation, with grinding heads on different levels and a turn-over conveyor setup, is shown finishing both sides of phenolic printed-circuit sheets. Included in this sequence is the operation which the Engelberg model replaced with a 16-to-1 production increase.

Engelberg Huller Co., Inc., 831 West Fayette St., Syracuse 4, N.Y. •

Use postpaid card. Circle No. 126

A BETTER BACK-UP WHEEL

R57

FOR YOUR ABRASIVE BELTS

45° scoop tooth used for aggressive stock removal

AVAILABLE NOW IN POPULAR 14" DIAMETER SIZES AT BIG SAVINGS

You can get the new R-57 RUBBER CONTACT WHEELS at lower prices in 14" DIAMETER sizes **due to newly developed production techniques. These new wheels have all the well-known features of the R50 and R-54 models.—LONGER BELT LIFE . . . OIL RESISTANT RUBBER . . . WET OR DRY OPERATION . . . HEAT DISSIPATION . . . MAXIMUM SAFETY . . . other features. And what's more these wheels have a 30% trade-in value.

**The new R57 and the R50 and R54 contact wheels are available in many popular sizes . . .½" to 22" DIAMETERS in WIDTHS from 1" to 6". Other wheels made to your specifications in all widths and diameters.

14"

TYPE	WIDTH OF FACE 1"	2"	3"	4"
PLAIN	32.00	34.00	36.00	38.00
SERRATED	37.00	39.00	42.00	44.00

AVAILABLE IN PLAIN OR SERRATED FACE IN ALL DUROMETERS

A WHEEL FOR EVERY OPERATION

Slit Serration	45° Standard	"X" Serration	Cosmo Expander
Aggressive Contact Work	Stock Removal	Moderate Contour Work	Backstand Idler Not Needed

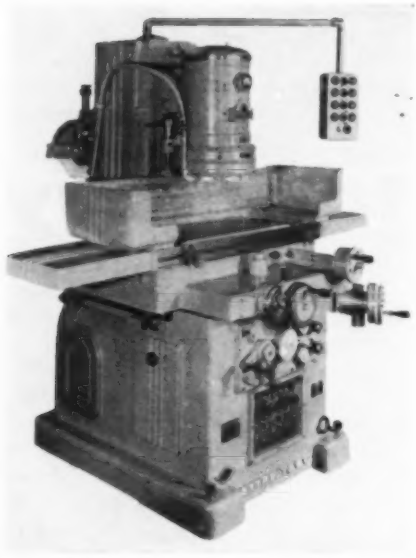
DElta 6-8900

CHICAGO RUBBER COMPANY, INC.

651 MARKET STREET • WAUKEGAN, ILLINOIS

Specializing in Contact Wheels and Industrial and Printers Rolls

Use postpaid card. Circle No. 267



Zocca "quick-change" surface grinder.

Swivelling Column Changes New Zocca Surface Grinder From Horizontal Into a Vertical or Universal Grinder

A new line of Zocca "Quick-Change" surface grinders which provide for horizontal, vertical and multi-angle grinding in the same basic machine, have been introduced by the New Equipment Division of S & S Machinery Company.

A turnabout column, rotating 180°, makes the vertical and horizontal heads interchangeable quickly. The grinder becomes multi-angular by mounting a universal head on either side. Rotation and positioning is effected in a matter of minutes by turning the column and clamping.

The new Zocca grinders in table sizes ranging from 12″ to 48″ in width, and 24″ to 360″ in length, combine hydraulically-driven automatic movements of feeds and speeds for high production of small and large workpieces. Dovetailing, vee-way and bedway grinding as well as straight surface grinding are all within the capabilities of the machine. Mounting the universal head makes it capable of grinding any angle from 1° to 180°, forward and back, left and right.

The down feed of the wheelhead, controlled independently, is infinitely variable with a range of from .0002″ to .0025″ per longitudinal stroke of the table. Power can be used for raising and lowering the grinding wheel, while a hand wheel is provided for fine adjustments, allowing workpieces to be ground to very precise limits.

The spindle is statically and dynamically balanced and is mounted on high pressure anti-friction bearings.

The table, with easily-selected progressive speeds from 3 to 100 feet per minute—the same in each direction—is hydraulically-driven by twin cylinders that provide uniform longitudinal travel and cushioned reversal. The extent of the table travel is controlled by sliding adjustable stops on the front edge of the table.

S & S Machinery Co., 140 53rd St., Brooklyn 32, N.Y. •

Use postpaid card. Circle No. 127

Chip Carts

Chips and turnings from the chip pans of automatics, lathes and grinders can be raked into the Model 43 and 44 Chip Carts which feature a lowered bin-type side. Permanently mounted side handles permit three position roll-over dumping of loads weighing up to 500 pounds.

The carts are mounted on four five inch ball bearing hard rubber swivel casters for maximum handling ease in narrow or crowded areas. Construction is 12 gage steel with reinforced loading and dumping lip and fully welded seams. Capacity of the Model 43 is 6.9 cubic feet. The Model 44 is identical in construction and design to the Model 43 but has a capacity of 8.7 cubic feet.

Coolant Equipment Corp., Verona, Wis. •

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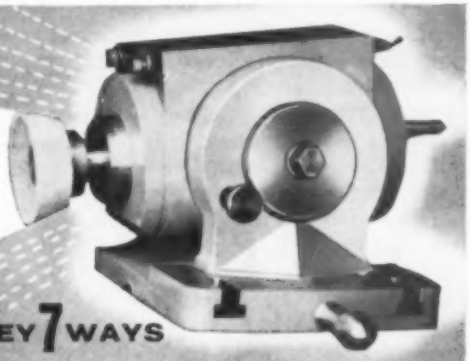
HERE'S AN

ANGLE



THAT SAVES YOU MONEY 7 WAYS
ON ALL YOUR TOOL AND CUTTER GRINDING

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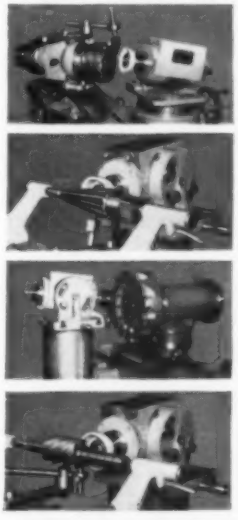
POPE SUPER PRECISION, 1 HP, 3600 RPM MOTORIZED TOOL AND CUTTER GRINDER CLEARANCE ANGLE SWIVELLING HEAD WITH ANGULAR ADJUSTMENT IN A VERTICAL PLANE



and get these seven savings:

1. Strong, long lasting tool cutting edges because cup wheel cutter grinding can be used for practically all clearance angles.
2. Tooth rest stays on the center line of the cutter for practically all grinding on centers or in the work head.
3. A single set-up grinds most cutters and reamers all over, using the swivelling table and Pope tilting head.
4. No more mistakes on clearance angles. They read directly in degrees from the scale provided on the head.
5. No more trouble or time wasted getting the right clearance angle on the tough ones such as slab mills, **taper reamers,** angular cutters and form tools.
6. No more heat checking of cutters. One safe speed — 3600 RPM — for all wheels generally used on cutter grinders.
7. Quick, easy adjustment saves you time and money every time you grind a tool.

Ask us to send you complete specifications including price and delivery.

No. 118

POPE® ENGINEERS AND BUILDS STANDARD AND SPECIAL PRECISION ANTI-FRICTION BEARING SPINDLES FOR EVERY PURPOSE

POPE MACHINERY CORPORATION • 261 RIVER STREET • HAVERHILL, MASS.

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Grinding and Finishing

News of Industry

American Society for Abrasives Formed– O'Connell Named Chairman

Answering a need which has long existed but never before been met, a group of men interested in many different facets of the abrasives field has formed a new nation-wide non-profit technical and study organization named American Society for Abrasives.

The Society plans to organize chapters throughout the country. The function of the chapters will be to hold meetings for technical discussions of all phases of the use, manufacture, and improvement of abrasives, to create good-fellowship among the members, and facilitate the exchange of knowledge gained from practical experience. The Society is well aware of the fact that while one man's experience with a certain abrasive's effect on a particular material may not be the precise answer to another man's problem, it may open up the way to a solution.

Chapters are now being organized in New England and in the Middle Atlantic States and steps are being taken to organize other chapters in Michigan and California.

One long-range objective of the Society, of great value of users and manufacturers alike, is the establishment of uniform standards for abrasives.

American Society for Abrasives is a non-profit corporation organized under the laws of Pennsylvania. The following officers have been elected: National Chairman—Ted J. O'Connell, Jackson, Michigan; President—John Y. Arnold, Reading, Pennsylvania; Vice-President—Raymond B. Ryder, Saugus, Massachusetts; Secretary—Jan L. Deelman; and Treasurer—Willard J. Miller, both of Reading, Pennsylvania.

In addition, the following were named directors: Howard E. Swatkins, Wallingford, Connecticut; James E. Bair, Pittsburgh, Pennsylvania; and Frank Blaine, New York City.

All the officers and directors are active in the use or manufacture of abrasives, except the secretary who is an attorney, and the treasurer who is an officer of the Mt. Penn Trust Company.

There are three classes of membership: Student (under 21); Senior (21 and over); and Associate (corporations and companies). Student members' dues are $5 per year, Senior $10, and Associate $100. For a limited time those applying for membership and admitted will be Charter Members. •

Ted J. O'Connell, Macklin Company, named national chairman of newly formed American Society for Abrasives.

Carborundum Launches "MAP" Program of Engineering Service by Mail

A new concept in abrasive technology called "Maximum Automation Potential," an abrasive and abrasive belt machine engineering service, developed by The Carborundum Company, gives manufacturers recommendations by mail for improved metal removal methods with predictions of savings over old methods that have a batting average of 90% accuracy, according to Mr. John Claydon, General Manager of the Company's Coated Abrasives Division.

The "Maximum Automation Potential" engineering service by mail, first of its kind in industry, is the cumulative result of several years' effort to help manufacturers move in the direction of greater mechanization and automation of stock removal methods through the use of coated abrasive belts, belt machines and special devices.

Traditionally, abrasive engineers have made individual in-plant studies and recommendations. But, progress in abrasive technology, particularly as applied to abrasive belt applications, has swamped the abrasive engineers in their attempt to keep customers abreast of cost saving advances in the use of new coated abrasive belts and belt machines. The abrasive engineers, through years of experience, had accumulated thousands of case studies in Carborundum's files. But how to get the benefit of this valuable information into the hands of manufacturers, without the neces-

sity of myriads of in-plant visits was the problem. The "Maximum Automation Potential" engineering service by mail was the answer.

Here's how M.A.P. was developed. Carborundum's coated abrasive and machine engineers took their engineering studies, recommendations and result data from the files . . . broke them down into classifications of customer application problems . . . isolated factors common to all of the classified types . . . isolated variables and resolved them into their least common denominator . . . Then the engineers reduced the data by categories into scientific formulae which could be applied to any manufacturer's problem in the respective categories.

Finally, the system had to be tested. This was done in laboratory setups simulating customer problems, and by extensive field testing.

Here's how M.A.P. works. The manufacturer writes to The Carborundum Company, Niagara Falls, New York, Attention: M.A.P. Department. By return mail the M.A.P. Brochure is sent to him. He details his problem in the form enclosed in the brochure and mails it to the M.A.P. Department. Coated Abrasive M.A.P. specially trained engineers study the manufacturer's problem, formulate an item by item recommendation, compare costs of the recommended new method with the method currently used and project increased production and savings. The free M.A.P. recommendation is promptly mailed back to the manufacturer for his consideration.

Mr. Claydon said he believes M.A.P. is the most advanced step ever taken in the abrasive industry to rationalize abrasive technology and to disseminate engineering know-how and the economics of metal removal to manufacturers. With this engineering service by mail we offer assistance to manufacturers on how to mechanize and automate their abrasive operations as far as it is possible and practical for them to go under the specific conditions presented in their confidential inquiry. Furthermore, and importantly, the economics of each recommendation is based on tested data that takes the guess work out of the manufacturer's planned conversion to improved metal removal methods. • •

First Abrasive Surface Grinder in Smithsonian

The original surface grinding machine which spurred the founding of the Abrasive Machine Tool Company of East Providence, Rhode Island, will soon be a valuable museum item. Abrasive Machine Tool Company president, Mr. Norman D. MacLeod, announced that the Abrasive No. 3 has been sent to the Smithsonian Institute in Washington, D.C. There it will be on permanent display in the Division of Engineering.

Built back in 1916, it was the first machine tool of its kind to utilize a solid one-piece casting frame with the motor mounted on the inside of the machine. These two features improved the machine's durability, greatly increased its efficiency and precision and added to its safety. So far ahead of its time was this original design that today, forty years later, these same features are employed by machine tool manufacturers the world over. The intervening years have witnessed few, if any, basic changes. •

First abrasive surface grinder, hand-made in 1916.

STONE CUT-OFF MACHINES do a better job

FASTER, CLEANER and at LOWER COST!

Stone

12" or 14" (Swivel Head) CUT-OFF MACHINE

CAPACITY: Ferrous, 1½" Solids, 2½" Standard Pipe and 2½" Structurals. Non-Ferrous, 2½" Solids, 3" Tubing and Extrusions.

MODEL M-35A is equipped with a quickly adjustable positive-locking swivel head for cutting up to 45° in either direction, providing superior operation at a lower original cost than any other comparable machine. Positive geared-in-head drive delivers all of its power to cutting wheel. The machine is designed and built to give you long, trouble-free service under the most rugged conditions. Adaptable for wet cutting.

MODEL M-35B (12" or 14" Cut-Off Machine) has same capacity as Model M-35A. Straight edges adjustable for 90° or 45° cutting. Adaptable for wet cutting.

MODEL M-35 (12" Cut-Off Machine) for 90° cutting has same capacity as Model M-35A.

Power stroke of cutting head and other optional equipment available for all of above. All three machines cut at a rate of less than 4 seconds per square inch, leaving a mill-like finish.

For specifications, optional equipment and costs, write to:

STONE MACHINERY CO., INC., 121 Fayette St. Manlius, N.Y.

STONE MACHINES ARE REPRESENTED IN EVERY MAJOR INDUSTRY THROUGHOUT THE WORLD

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BEAVER CUT
CARBIDE

Cushion Ground and Micro-Lapped Rotary Files, Grinding Burrs, and Center Lapping Tools outlast regular ground carbide tools by 30% yet cost no more.

You may make a greater saving by sending us your dull tools for sharpening by our manufacturing method.

Beaver Cut Rotary File Company
401 E. Slauson Ave.
Los Angeles 11, Calif.

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Taft-Peirce Establishes Instrument Gage Division

A new Instrument Gage Division has been established by Taft-Peirce Manufacturing Co., according to Vice-President F. Steele Blackall II. Taft-Peirce first entered the instrument gaging field in 1947. An Instrument Gage Department was subsequently organized to increase Taft-Peirce service to industry with a product line of air gaging and related equipment.

The Instrument Gage Division will be under the direction of Franklin Meyer, Jr., as manager. Prior to this appointment he was Chief Engineer, Instrument Gages. Mr. Meyer joined Taft-Peirce in 1947, after holding various production and engineering assignments in the instrumentation and gaging fields. Mr. Meyer is a graduate of Drexel Institute.

"This reorganization was effected to further expand company development and production facilities for air and electronic air gaging," stated Mr. Blackall. "The new Instrument Gage Division will offer complete services for engineering, application, sales and manufacture of both standard and special air and electronic gage and instrumentation designs. Taft-Peirce semi-automatic and automatic gaging systems have seen tremendous growth in mass-producing industries; and Taft-Peirce will now be equipped to provide full support to users through the Instrument Gage Division." •

Aluminum Brake Drums for Buick

Tucked away in Buick's announcement of a new luxury series of cars is another first for the automotive industry. It is the introduction of air-cooled aluminum brakes to passenger car production, according to DuPont Yager, Great Lakes regional general manager for Reynolds Metals Company.

"Buick," Yager said, "seems to be the first to solve a major problem facing auto engineers today, namely how to match brake power to horse power at new performance peaks."

Quoting industry statistics showing an average of 10% increase in total car weight since 1946 and diameters of wheels decreasing from 16 inches to

Stay ahead of your competitors

with these
Production Advantages:

You can gain these advantages, and more, through specification and control of surface roughness with the PROFILOMETER®. The methods are easy to apply, and are based on the following facts:

(1) In many cases, the performance of a part in service depends on whether it is smooth enough — or rough enough — often within close limits.

(2) Entirely apart from product quality, roughness control is the key to substantial *production economies.*

(3) The Profilometer quickly *measures* roughness, with *dependable accuracy*, in microinches — *at the machines.*

★ Get BETTER and MORE UNIFORM QUALITY OF PRODUCTS!
★ DETECT and eliminate UNNECESSARY OPERATIONS!
★ AVOID OVER-FINISHING!
★ FURTHER SAVE TIME in Sizing and Finishing!

FREE BULLETIN LT14 gives details. Write for it!

Profilometer is a registered trade-mark.

MMC MICROMETRICAL MANUFACTURING COMPANY
341 S. MAIN ST. ANN ARBOR, MICHIGAN

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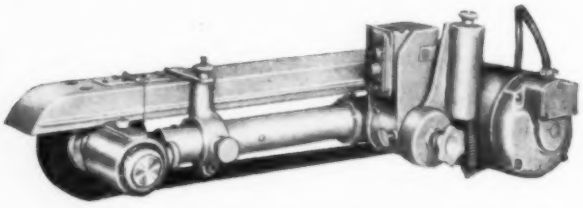
THE G & P 6-72 BELT UNIT



Adaptable for almost every type of belt grinding and polishing

ADAPTABLE: 1. it is simple in design, lends itself to changes and elaborations; 2. it has a capacity for finishing large and small pieces; 3. can be used as both a primary or an auxiliary component of machines; 4. it is a machine in its own right; 5. it has mobility; and 6. it can be used for off-hand finishing or mounted to obtain accurate dimensions. Write for Bulletins No. 104 and No. 105 for full details.

Makers of the famous MARSCHKE grinders and buffers.

Grinding and Polishing Machinery Corp.
SUCCESSORS TO VONNEGUT MOULDER CORPORATION
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15 and 14 on some current models, Yager said that adequate braking is becoming dramatically dependent upon the ability to dissipate searing heat quickly. Aluminum is said to offer this ability.

New Atlanta, Indianapolis Offices for Norton

Norton Company has established two new district offices, one in Atlanta, Georgia, and the other in Indianapolis, Indiana. **Norman R. Ekholm** has been appointed district manager in Atlanta and **John R. H. Truelsen** will assume the same post in Indianapolis. Both appointments become effective April 1.

Ekholm has been an abrasive engineer on the West Coast since 1946. Truelsen has been an abrasive engineer for the company since 1947. His first post was in Wisconsin and since 1951, he has been assigned to the northern Illinois area. •

Left, N. R. Ekholm, new Norton district manager, Atlanta. Right, J. R. Truelsen, Indianapolis district manager.

Briefs

Harold Hechtman has been named Director of Public Relations of Airborne Instruments Laboratory, Inc., Mineola, N. Y. Hechtman, who was formerly Administrative Assistant to the President, joined the company in June of 1951.

Charles E. Pretzinger has been appointed Pacific Coast district manager of Pangborn Corporation, Hagerstown, Md. Pretzinger has served as district sales engineer with Pangborn in their Pacific Coast office since 1948 and was previously associated with the Link Belt Company as an industrial engineer.

Charles D. Coxe has been appointed Manager, Metallurgical Department, Handy & Harmon. His responsibilities will include operation of the company's technical and assay laboratories, technical control in plants and powdered metal products manufacturing.

Harold Hechtman, public relations director, Airborne Instruments Laboratory.

C. E. Pretzinger, Pacific Coast manager, Pangborn Corporation.

Charles D. Coxe, metallurgical department manager, Handy & Harmon.

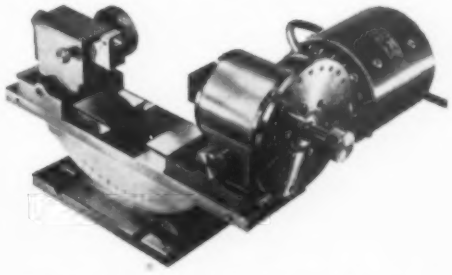
Ernest S. Griswold, chief product engineer, Pratt & Whitney cutting tool division.

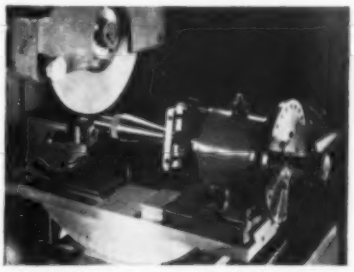
Ernest S. Griswold has been appointed chief product engineer of the cutting tool division of Pratt & Whitney Company Inc. Griswold will report to Stanley W. Lovejoy, manager of engineering and research of the cutting tool division.

Rodger J. Emmert, assistant to the General Motors vice president in charge of Process Development Staff, is retiring under the General Motors retirement plan after 38 years of service.

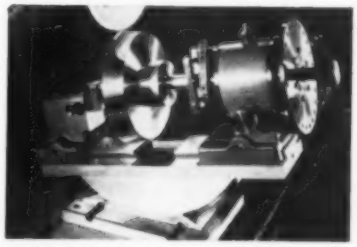
Save on small grinding jobs with Moore Motorized Centers

Toolroom attachment for surface grinders, jig borers, drill presses, millers, etc., handles flat, curved or circular work in one setting.

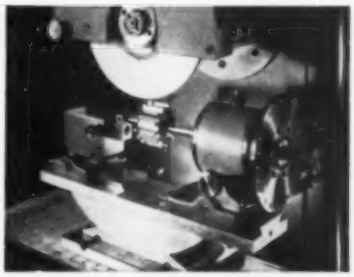




Double tapers and hex shoulder ground with a single setup.



Grinding a 10° taper on a machine part 5" long, 5" in diameter on centers.



12 equally-spaced slots in punch holder ground by using index plate.

You no longer need to tie up large machines on grinding square and round punches ... doing taper grinding, index grinding and face-plate work. Moore Motorized Centers, a portable, precision-built accessory, can be set on a surface grinder chuck in a jiffy and the job completed quicker than the grinding wheel on a large machine can be changed. You'll save on toolroom labor and materials.

With Motorized Centers, in one setting, you can grind flat, curved or circular work—in any combination of taper or contour—all within .0005". The index plate allows indexing in the same operation, too. Tapers can be reversed or changed by loosening two screws in the rocking bed, and the index plate can be engaged by merely pressing a plunger. The simple tail-stock center readily permits the use of specials—male, female or cutaway.

Catalog with 20 Action Photos shows many toolroom jobs you can handle with this versatile tool. Write for a copy today.

SPECIFICATIONS	
Length—overall	12"
Width—including motor	10"
Height—overall	8"
Distance between centers—maximum	6"
Centers will swing	6"
Max. grinding angle (using 10° angle block)	30°
Motor	1/25 H.P., 115 volt, 60 cycle
Work Speeds	110-220-440 R.P.M.

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725 Union Avenue, Bridgeport 7, Conn.

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NEW HONING LAP

⅓ DIAMOND COST

$8.75

95% DIAMOND HARDNESS

- Fast, efficient, removes material, produces an absolutely smooth finish on tool steels and on the hardest carbide tools.
- Macolaepp grains are harder than the toughest sintered carbides . . . hardness of 9.5-9.8 on the Mohs scale, against 10 for diamond.
- Convenient handle eliminates the difficulty of working with a thin, awkward hone.
- Thirty times as much abrasive material cost less than 1/3 the price of a comparable diamond hone.
- Grains are sintered and bonded under extreme pressure. The high density and great quantity of hard grains guarantee long life and even cutting action.
- There is a proper honing tool for each job, depending upon the finish desired and the amount of material to be removed.

For HEAVY abrasion on carbide tools use: No. 180 - Yellow
For MEDIUM carbide MEDIUM steel use: No. 220 - Blue, No. 360 - Red
For FINEST FINISH after honing, use..... No. 500 - Green

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Oscar L. Joseph, new plant manager, Associated Spring Corporation Barnes-Gibson-Raymond division.

David M. Gaskill, Brush Electronics manager of industrial sales.

H. Perry Smith, assistant director of research, Associated Spring Corp.

R. L. Stevenson, executive vice president, U. S. Hoffman.

Oscar L. Joseph has been named plant manager of the Ann Arbor plant of Associated Spring Corporation's Barnes-Gibson-Raymond division. Joseph succeeds **Melvin E. Donally,** who retires March 1 after 50 years with the company and its predecessor, the Cook Spring Company.

David M. Gaskill has been appointed manager of industrial equipment sales for Brush Electronics Company, a division of Clevite Corporation, according to an announcement by C. B. Hoffman, Brush vice president and general sales manager.

H. Perry Smith, formerly manager of the general research laboratory of Underwood Corporation in Hartford, Conn., has joined Associated Spring Corporation, Bristol, Conn., as assistant director of research, according to an announcement by Walter E. Froehlich, vice-president.

Revis L. Stephenson has been named executive vice president of United States Hoffman Machinery Corporation. In addition to his new responsibilities, Stephenson will retain his Directorship of the Hoffman Foreign & Export Operations, and supervision of the Industrial Divisions.

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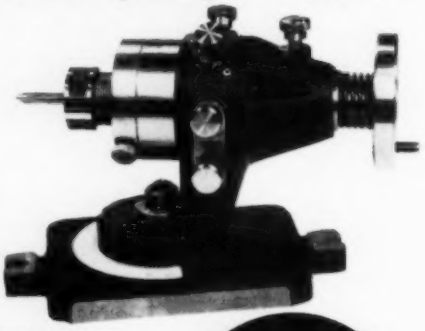
HIGH QUALITY PRECISION TAP GRINDER

Makes Grinding A Tap As Easy As Sharpening A Pencil!

Has All the Money-Saving Features of Higher Priced Machines!

Grinds and Relieves Chamfers of any Tap, Right or Left, up to ⅝".



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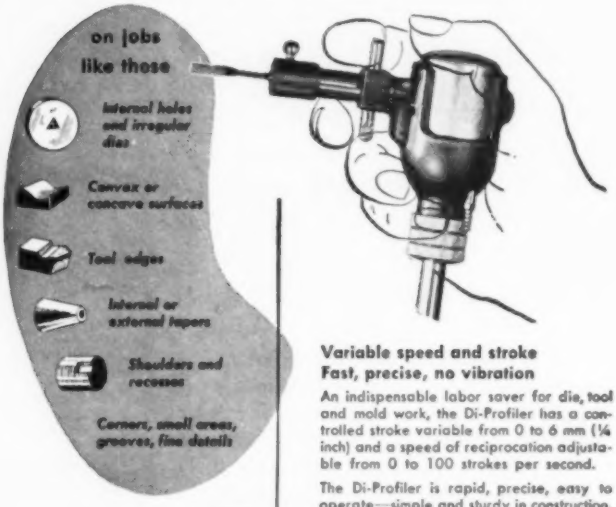
RECIPROCATING HAND MACHINE

for time-saving cutting—roughing—finishing


on jobs like these
Internal holes and irregular dies
Convex or concave surfaces
Tool edges
Internal or external tapers
Shoulders and recesses
Corners, small areas, grooves, fine details

Variable speed and stroke Fast, precise, no vibration

An indispensable labor saver for die, tool and mold work, the Di-Profiler has a controlled stroke variable from 0 to 6 mm (¼ inch) and a speed of reciprocation adjustable from 0 to 100 strokes per second.

The Di-Profiler is rapid, precise, easy to operate—simple and sturdy in construction. Its weight of less than one pound and freedom from vibration eliminate fatigue and assure perfect control for the most intricate work.

Moderately priced, the Di-Profiler pays for itself many times through time-saving cost reductions.

Write for free demonstration or illustrated price list DG-47

Tools for every type of work
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NEW HIGH SPEED
HEAVY PRODUCTION
AT LOW INITIAL COST

A popular disc grinder that incorporates features wanted most by industry. Table moves up and down, tilts accurately and squares automatically. Wrap-over guard tilts back to handle work at top of disc. Available in three disc sizes, 15", 16", 20" Specifically engineered to handle heavy production schedules at high speed with extreme accuracy. Economically priced. Write today for complete information and name of distributor nearest you.

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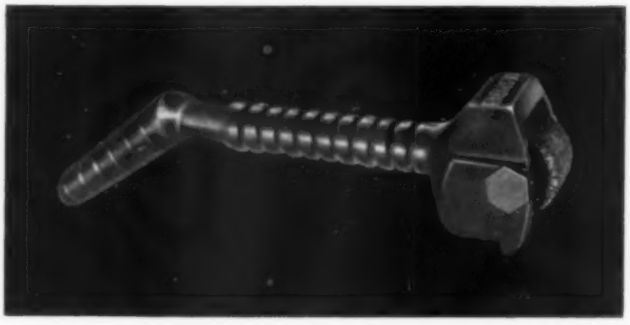

For coated abrasive belts, Desmond's new BELTBRASIVE dresser lengthens service life an average 40%—substantially increases stock removal at the same time. Works on discs, belts, polishers—saves changing time. Apply BELTBRASIVE dresser lightly when abrasive begins to load. Ask your Desmond distributor or write for bulletin D-12.

The only complete line of grinding wheel dressers and cutters

Desmond

THE DESMOND-STEPHAN MFG. CO., URBANA, OHIO

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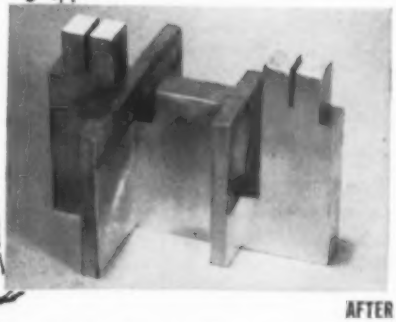
Whipped this Tricky Deburring Job in a Matter of SECONDS

BEFORE



AFTER

Sand-O-Flex the flexible sanding wheel finishes and polishes in record time. Firm cushioning banks of bristles, backing projecting strips of abrasive cloth force the abrasive into and around intricate surfaces "wiping clean" burrs, flash and tool marks in seconds, without flatting or digging . . . produces satin finishes too. Fresh abrasive strip unwinds from cartridge . . . refill cartridges available. Coarse, medium or fine grits. Attaches to your present power tools or any rotating spindle. There's nothing as fast for contoured or intricate steel, chrome, aluminum, brass, magnesium, wood, plastic surfaces.

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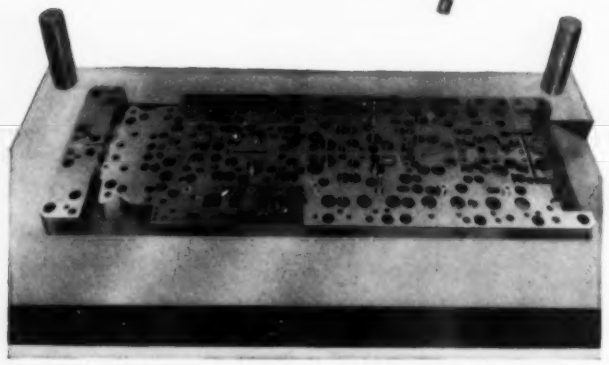

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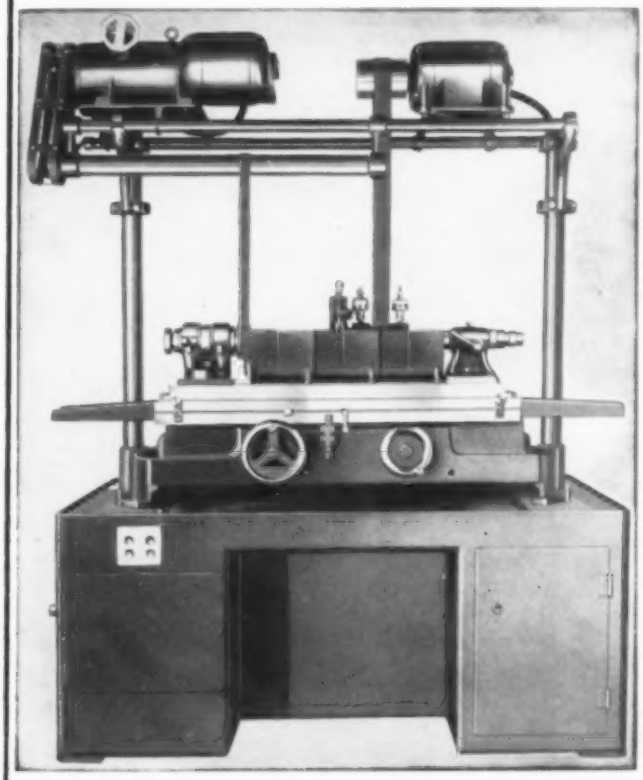

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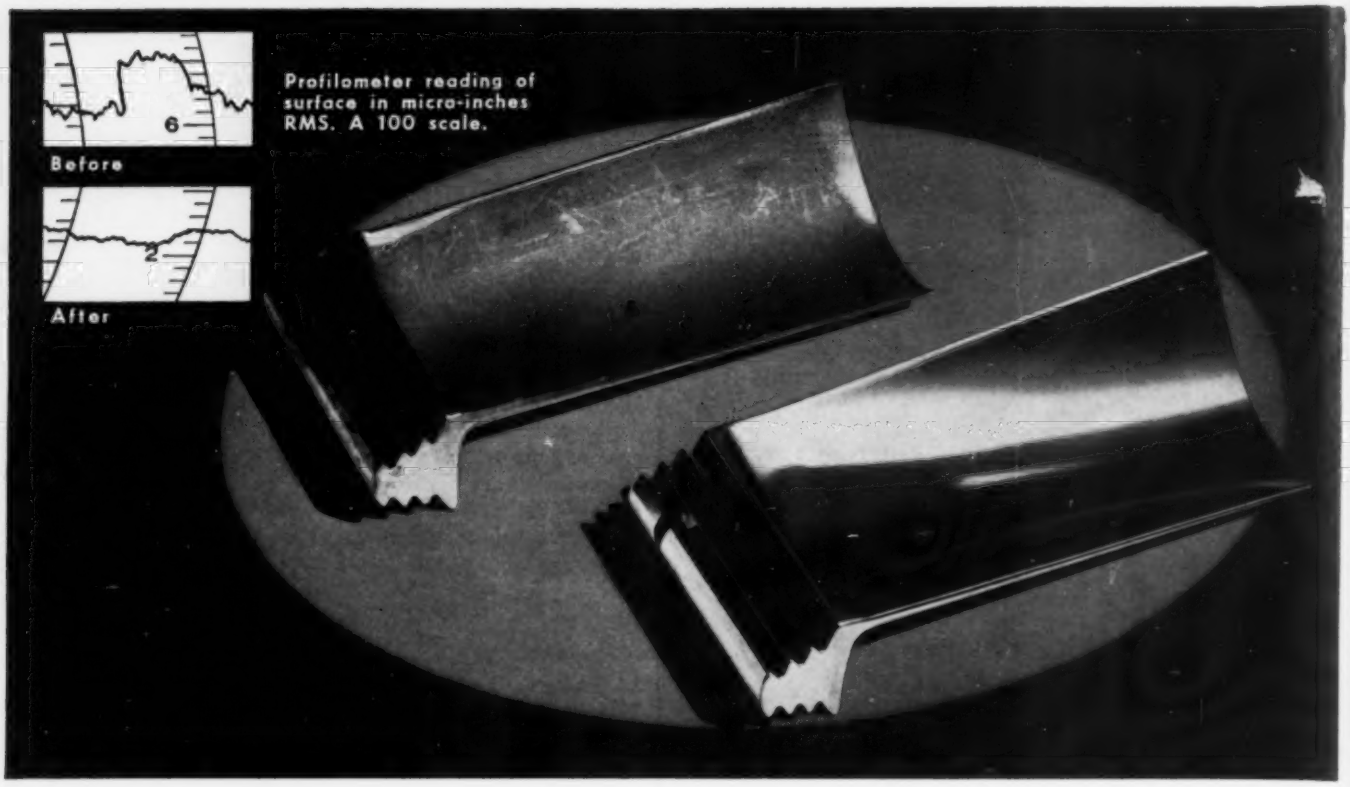

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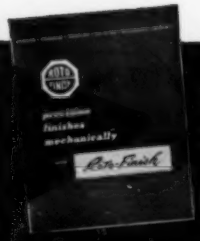

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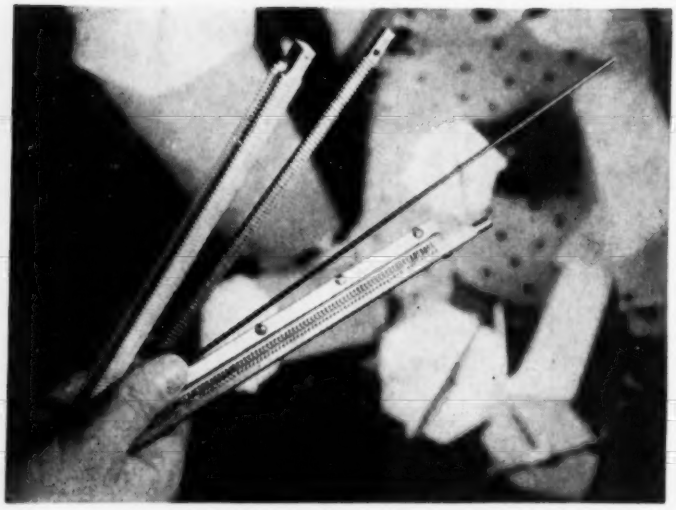

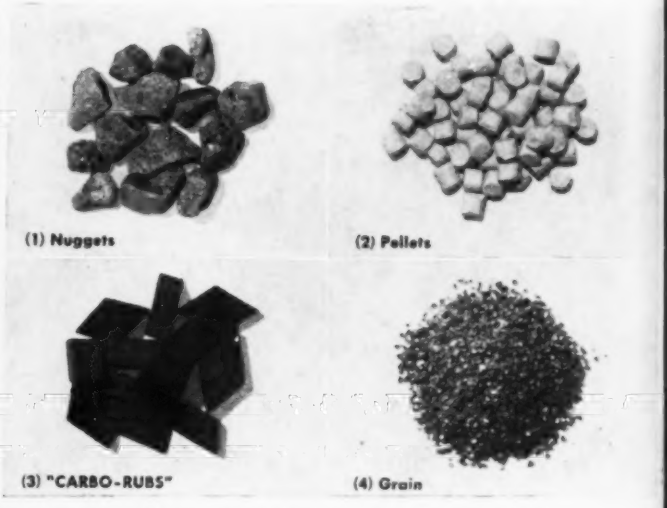

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